Alternate A-Direct Discharge Concept

PRELIMINARY TECHNICAL INFORMATION REPORT And DOWNSTREAM ANALYSIS for

TALL CHIEF COUNTRY CLUB RESIDENTIAL PLAT PROJECT

Location:
1313 W. SNOQUALMIE RIVER ROAD
FALL CITY, WA 98024

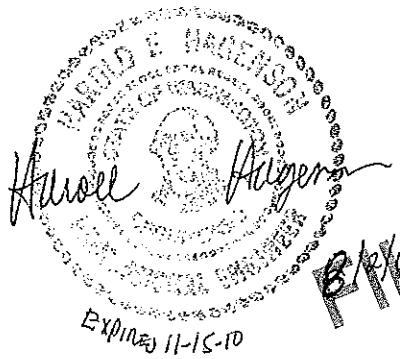
DECEMBER 23, 2004
Revised Dec 15, 2006
Revised 4/11/08
Revised 2/2/09

By

Hagenson Consultants, LLC
Seattle, Washington 98136

HC Job No. 200422

K.C Project # L04P0032

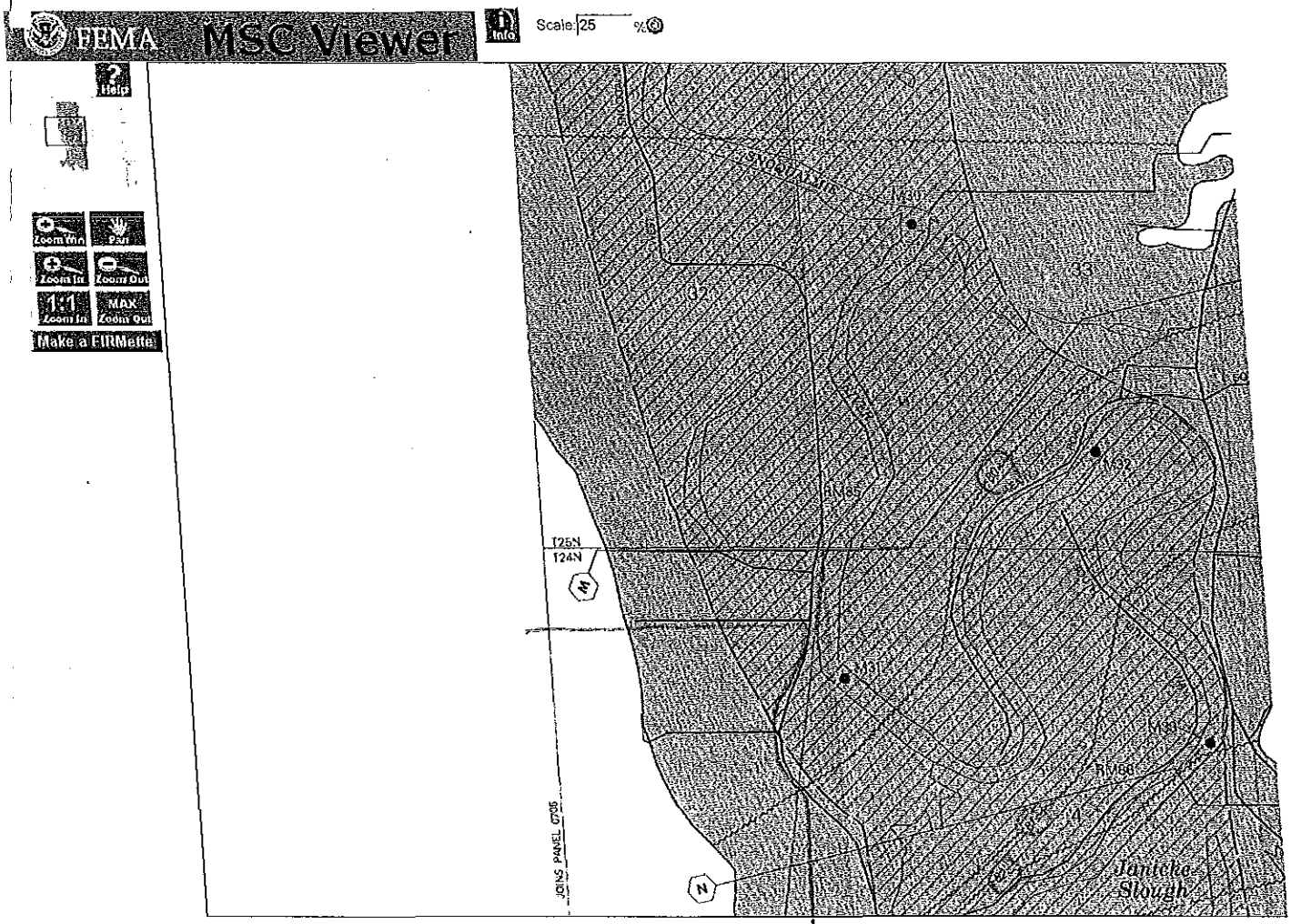


8/18/09

REVISION

H-5B-1

L04P0032



SITE

NGVD

NGVD

SITE TOP NAVD 88

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM85	73.50	Boat spike 1.5 feet above ground on downstream side of 30 inch maple tree at river bank, on east side of West River Road (308th Avenue Southeast).
RM86	91.36	1/2 inch rebar protruding 2 inches out of concrete porch and walkway between barn and house, at downstream landward corner of porch; at north end of SE 24th Street, about 1/4 mile from intersection with 312th Avenue SE.
RM91	72.28	A boat spike 1.5 feet above ground on 2-wire power pole, 3 feet east of fence line on downstream riverward side of pole, about 400 inches upstream from two concrete silos; farm is located on east side of West River Road (Pleasant Hill Road).

Web Date: 11/16/2005

King County
Department of Development and Environmental Services
900 Oakesdale Avenue Southwest
Renton, Washington 98055-1219
206-296-6600 TTY 206-296-7217

SURFACE WATER DESIGN MANUAL REQUIREMENTS / STANDARDS ADJUSTMENT* REQUEST

For alternate formats, call 206-296-6600.

Project Name: Tall Chief Plat		DDES Project File No: L04P0032 DDES Engineer/Planner Name: Pete Dye	
Project Address: 1313 W. Snoqualamie River Road		Design Engineer: Hal Hagenson, P.E.	Phone: 206-938-6168
Applicant/Agent**: De-En Lang/Lang Associates	Phone: 206-360-8880	Signature of Design Engineer: Hal Hagenson	Date: Revised 4/11/08 6/20/07
Signature of Applicant/Agent:	Date:	Engineering Firm Name: Hagenson Consultants, LLC	
Address: 10658 Riviera Place NE	City, State, ZIP: Seattle, WA 98125	Address: 6484-48th Ave SW	City, State, ZIP: Seattle, WA 98136

INSTRUCTIONS TO APPLICANT/DESIGN ENGINEER:
Please be sure to include all materials (Level One Downstream Analysis, Certification of Applicant Status, sketches, photos, and maps) that may assist in complete review and consideration of this adjustment request. Failure to provide all pertinent information may result in delayed processing or denial of request. Please submit two complete copies of this request, application form, and applicable fee to the Department of Development and Environmental Services, 900 Oakesdale Ave. SW, Renton, WA 98055-1219. For more information, contact Mark Bergam, P.E., at 206-296-7270.

****Applicant/Agent is the individual financially responsible for all fees**

REFER TO CHAPTER 1, SECTION 1.4 OF THE *SURFACE WATER DESIGN MANUAL* FOR ADJUSTMENTS

DESCRIPTION OF ADJUSTMENT REQUEST: ☒ Standard ☐ Complex ☐ Experimental ☐ Blanket ☐ Pre-application

Adjustment requested to allow the diversion of a portion of the Patterson Creek sub-basin of the property to be direct discharged to the Snoqualamie River.

APPLICABLE VERSION KCSWDM: ☐ 1990 (11/95)* ☒ 1998 (9/98) ☐ 2005 (1/05)

*(Note: the term "variance" replaced by "adjustment")

APPLICABLE SECTION(S) OF STANDARDS:

KCSWDM 1.2.1 Discharge at the Natural Location

JUSTIFICATION PER KCSWDM SECTION 1.4.2: ☒ See attachments listed below.

(See Attached Exhibit A)

AUTHORIZATION SIGNATURES:

DETERMINATION: ☐ Approval ☐ Conditional Approval (see below) ☐ Denial

☐ DNRP/WLRD Approval Signed: _____ Date: _____ (Experimental & Blanket only)

DDES Staff Recommendation Signed: _____ Date: _____

Conditions of Approval:

☐ See attached memo dated: _____

DDES DIRECTOR / DESIGNEE:

DDES, LUSD, Engineering Review Supervisor:		**DDES, BSD, Site Engineering & Planning Supervisor**	
Signed:	Date:	Signed:	Date:

Check out the DDES Web site at www.metrokc.gov/ddes

Attachment A
Surface Water Design Manual Requirements/ Standards Variance Request
Project: Plat of Tall Chief Country Club

Project General Description

The Proposed Development includes platting 18 residential lots on the existing 191.2 acres, consisting of 4 separate tax parcels. Clustering will be used such that the northerly 9 holes of the existing 18-hole country club golf course will be reverted to agrarian or conservancy uses. Construction of a new Rural Minor access road (Tall Chief Road and Aldera Ridge Road) will provide the necessary access. Emergency Access will be provided via Aldera Emergency Access Road and Campground Road. Existing Zoning is predominantly RA-10 with some RA-5-P. The site is located at 1313 West Snoqualmie River Road in un-incorporated King County, near Fall City, WA. Grading, utility and drainage improvements will be prepared in compliance with the current County Code based on the 1998 surface water manual.

The northerly ¾ of the site lies in the Snoqualmie River Basin, while the remainder lies in the Patterson Creek Basin. Grading, utility and drainage improvements will be prepared in compliance with the current County Code.

Summary of Existing /Proposed Drainage Patterns

Existing site drainage patterns are discussed in detail in the Preliminary TIR and Downstream Analysis, dated ~~March 22, 2007~~ prepared by Hagenson Consultants, LLC. The following is a brief summary. 2/2/09

The southern site drainage lies in the Patterson Creek Basin. Drainage from the hillside is currently largely un concentrated as it runs through the forested hillside. At the upper back 9-hole golf course elevation, dainage is conveyed downstream from that point in gullies to the slough at the valley floor. Drainage patterns will be maintained for some of the Patterson Creek Basin by using roof and driveway dispersal systems for lots 8 thru 12. However, a SWM Drainage Adjustment is sought to allow diversion of a 21.0-acre portion of the Patterson Creek Basin to be directly discharged to the Snoqualmie River in a piped storm water system. This direct discharge conveyance system would collect drainage from the Tall Chief and Aldera Ridge Roads, as well as onsite areas upstream thereof, and direct them to the proposed direct discharge system for the Snoqualmie basin portion of the project (as discussed below).

The northern site drainage lies in the Snoqualmie River Basin. Drainage from the hillside is also largely unconcentrated as it runs through the forested hillside. Several shallow grassy swales intercept hillside runoff and direct it towards the steep slope banks on the central easterly perimeter of the project. At the lower front 9-hole golf course elevation (i.e. the north portion of the project), drainage is intercepted into a series of channels and wetland ponds lying at the base of the hillside. Drainage from this channel is conveyed northerly to it's natural discharge point near the northeast portion of the project boundary and eventually towards the offsite "Green" slough and the Snoqualmie River. Drainage patterns for the Snoqualmie River Basin portion of the project will be maintained to their current condition for a variety of lower events, such that base flows will be directed to the Green slough and associated wetlands as a means of mitigating impacts. This will be accomplished by installing a weir diversion system at the outfall of the proposed wet pond. Lower flow events selected to mimic existing runoff conditions would be directed to the natural location, and higher events (such as the developed 2 year, 10 year and 100 year events), would be diverted to the direct discharge pipeline.

Of note, 2006 draft FEMA FIRM updates indicate the Snoqualmie River and Patterson Creek 100 year floodplains are concurrent at a point upstream from where the project drainage discharges from the site. In some terms, this may be interpreted as indicating that the Patterson Creek sub-basins and the Snoqualmie sub-basins are inseparable at this point, further providing justification for the basin diversion.

The proposed draft FIRM also indicates a revision to the project flood plain elevations, down from 185 in the current versions to elevation 184 to 182 in the draft version.

Proposed Drainage Impacts

Several major concerns were identified as potential impacts that could result from development of this site (if not mitigated). There were:

1. Pollutants in the urban runoff discharged in the natural system could adversely affect the water quality of downstream receiving waters (Patterson Creek and Snoqualmie River).
2. Discharge of developed state runoff to Patterson Creek could potentially increase flood flows and/or flood levels in Patterson Creek.
3. Collection and discharge of developed state runoff at the natural location in Patterson Creek Basin, especially if developed utilizing the 65% Forested Open Space Exemption Number 5(KCSWDM sec 1.2.3), or if otherwise infiltrated or detained in open ponds, would require discharging onto and across slopes and steep slopes potentially resulting in new and or increased erosion and slope instability (see geotechnical report, Soil and Environmental Engineers, Inc., dated Dec 14, 2005, copy included in preliminary TIR).

Proposed Drainage Mitigation

The proposed drainage plan was specifically designed to avoid the potential impacts listed above. The key aspects of the proposed drainage system are described below.

The site lies in a level two flow control area. However, the entire site qualifies for exemptions as follows:

The Patterson Creek Basin portion qualifies for the Forested Open Space exemption number 5. This portion of the project is a rural residential project in the RA-5 and RA-10 Zone. 65% of the un-submerged drainage area will be dedicated in easements or tracts as Forested Open Space. BMP's such as roof and driveway dispersal will be used to accommodate drainage requirements on each of the Patterson Creek basin lots and any of the Snoqualmie Basin lots which cannot stub directly into the roadway storm drains.

Roof drain dispersal will largely rely on the splash block method, with 50' min. vegetated flow paths between the roof and any structure or property line. Road dispersal for the driveways will rely partially on sheet flow and where concentrated flows result from roadway cut ends or uphill ditch systems, direct discharges to rock pads with 100 foot flow paths thru vegetation will be allowed where 100 year flows are less than 0.2cfs. Dispersion trenches will be used otherwise, such that any 50' dispersion trench receives no more than 0.5 cfs in the 100-year event. In compliance with the geotechnical report recommendations, emphasis is placed on collecting runoff from the hillside bench area and discharging it to the valley floor in an effort to avoid erosion and instability. To facilitate this, a French drain is proposed at approximate elevation 330 along lots 13 thru 16. Extensive sub-basin delineation and modeling will be provided at the construction document phase.

Approximately 21.0 acres of the Patterson Creek Basin will be diverted northwards along proposed Tall Chief Road and ultimately directly discharged to the Snoqualmie River along with those portions of the project that lie in the Snoqualmie River Basin. A SWM Drainage Adjustment application is made for this purpose. The diversion will further allow the removal of drainage from the hillside to avoid erosion and instability for the benefit of the project. It is assumed that a geohydrologic report must be prepared to show that there are no surficial or interflow aquifers present which might otherwise affect the Patterson Creek base flows. However, given that the Patterson sub basin is the lowest portion of the basin prior to confluence with the Snoqualmie River, we have assumed this conclusion is highly likely.

The Snoqualmie River Basin portion qualifies for the Direct Discharge exemption number 6. The site flow path from the project site to the edge of the 100-year floodplain is less than ¼ mile (portions of the site actually lie within the 100 year floodplain). The

proposed conveyance systems will consist predominantly of pipes with some ditches, with capacity for the full-developed build out condition as well as existing undeveloped on-site tributary natural areas. Appropriate erosion protection measures will be used, such as rock lining of steeper channels.

Drainage patterns for the Snoqualmie River Basin portion of the project will be maintained to their current condition for a variety of lower events, such that base flows will be directed to the Green slough and associated wetlands as a means of mitigating impacts. This will be accomplished by installing a weir diversion system at the outfall of the proposed wet pond. Lower flow events selected to mimic existing runoff conditions would be directed to the natural location, and higher events (such as the developed 2 year, 10 year and 100 year events), would be diverted to the direct discharge pipeline.

The site lies in a Basic Water Quality area.

For the southerly Patterson Creek portion of the project, exemption number 3, Forested Open Space for Rural Residential Projects will apply (KCSWM pg. 1-50 to 1-51). Exemption #3 indicates that any proposed natural discharge area within a project is exempt provided:

1. At least 65% of the unsubmerged portion of the natural discharge area is set aside as forested open space as specified in Section 5.2.1 and
2. The runoff from roads and driveways is dispersed through at least 100 feet of native vegetation (per 5.2.1) and
3. The runoff from continuous lawn areas of 1 acre or more is dispersed through at least 25 feet of native vegetation onsite per 1.2.8.2 (P-1-57).

Per KCSM manual, PG 5-15, appendix C and Section 4.2.2, runoff dispersal can be used as an alternative method to accomplish water quality requirements, such that filtration through grass/pasture removes harmful pollutants. This approach will be applied to those portions of the Patterson Creek sub-basin that are not otherwise directly discharged to the Snoqualmie River.

Water Quality facilities in the Snoqualmie Basin (and those portions of the Patterson Creek sub-basin which are directly discharged to the Snoqualmie River) will consist of a wet pond in the lower front 9 hole portion of the project. A portion of this facility lies within the 100-year floodplain. Consequently, a compensating volume will be excavated from the hillside areas near Tract A to create mitigation floodplain storage.

A copy of the current geotechnical review is attached in the appendix of the TIR.

As noted above, roof downspout dispersal will be utilized for all buildings, as required. *Design details will be provided in section IV of the TIR for the Construction Document phase of the project.*

Requested Variance No. 1

1998 KCSWM Manual – Section 1.2.1-Core Requirement #1: Discharge at the Natural Location

Description of Variance Request

The KCSWDM requires that the discharge from a proposed project site must occur at the natural location. This variance request is to allow approximately 21.0 acres of the site that currently lies in the Patterson Creek Drainage Basin to be directly discharged into the Snoqualmie River.

Justification

Various options for control of surface water runoff from the developed Paterson Creek Basin site area have been examined. Construction of the Snoqualmie River diversion pipeline and diversion of runoff from developed areas to the Snoqualmie River was found to be the best option for managing runoff from the site. Several alternatives were examined, these include:

1. Discharge using flow dispersal BMP's throughout the sub-basin.
2. Recharge through infiltration facilities.
3. Diversion to the Snoqualmie River.

Options 1 and 2 were found to have severe deficiencies when compared to Option 3, diversion. The following discusses each of the three potential options.

- The Patterson Creek sub-basin contains no defined drainage course to which site drainage can discharge.
- Due to the presence of steep slopes and moisture sensitive geologic formations within the Patterson Creek sub-basin, the use of dispersal methods and/or infiltration methods is not recommended (see geotech report). Such practices could serve to increase the erosion potential and potentially de-stabilize slopes and steep slopes.
- Diversion of the Patterson Creek Sub-basin from its' natural point of discharge will not significantly affect downstream properties. The adjacent property owner to the east is the Lien property.
- Diversion the Patterson Creek Sub-basin will not significantly affect downstream hydrologic features. Based on the "Groundwater and Interflow Impact Study", prepared by Associated Earth Sciences, Inc (AESI), 1999 for the proposed Treemont Plat, no drainage course that contributes base flows to downstream wetlands will be diverted. The bypass pipeline will not divert downstream drainage courses from their natural course. Where the bypass pipeline crosses wetlands downstream onsite, it will be designed to maintain base flows to the lower, northerly wetlands on the Tall Chief site, by use of "flow splitter weirs).

- Diversion of the Patterson Creek Sub-Basin will not significantly affect the recharge of springs/seeps/wetlands that contribute to the base flow of Patterson Creek. The "Groundwater and Interflow Impact Study", AESI, 1999, determines that the significant drainage courses above the site that contribute base flow to Patterson Creek are not fed by surficial aquifers or interflow. The diversion will not impact deep aquifers.

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B. CORE AND SPECIAL REQUIREMENTS ANALYSIS

This section of the TIR is intended to meet agency specific requirements for a report addressing all Core and Special Requirements of the 1998 King County Surface Water Manual.

Core Requirement 1. Discharge at the Natural Location

The southern site drainage lies in the Patterson Creek Basin. Drainage from the hillside is currently largely un concentrated as it runs through the forested hillside. At the upper back 9-hole golf course elevation, drainage is conveyed downstream from that point in gullies to the slough at the valley floor. Drainage patterns will be maintained for Lots 8 thru 12 in the Patterson Creek Basin by using roof and driveway dispersal systems. However, a SWM Drainage Adjustment is sought to allow diversion of a 21.0-acre portion of the Patterson Creek Basin to be directly discharged to the Snoqualmie River (see Basin Map). This direct discharge conveyance system would collect drainage from the Tall Chief and Aldera Ridge Roads, as well as areas upstream thereof, and direct them to the proposed direct discharge system for the Snoqualmie basin portion of the project (as discussed below).

The northern site drainage lies in the Snoqualmie River Basin. Drainage from the hillside is also largely unconcentrated as it runs through the forested hillside. Several shallow grassy swales intercept hillside runoff and direct it towards the steep slope banks on the central easterly perimeter of the project. At the lower front 9-hole golf course elevation (i.e. the north portion of the project), drainage is intercepted into a series of channels and wetland ponds lying at the base of the hillside. Drainage from this channel is conveyed northerly to it's natural discharge point near the northeast portion of the project boundary and eventually towards the offsite "Green" slough and the Snoqualmie River. Drainage patterns for the Snoqualmie River Basin portion of the project will be maintained to their current condition by means of a proposed weir outlet at the proposed wet pond, which will send lower flow events toward the on-site central swale that leads to the Green Slough. Larger event storms (2, 10, 100 year events) will be directly discharged to the Snoqualmie River.

Of note, 2006 draft FEMA FIRM updates indicate the Snoqualmie River and Patterson Creek 100 year floodplains are concurrent at a point upstream from where the project drainage discharges from the site. In some terms, this may be interpreted as indicating that the Patterson Creek sub-basins and the Snoqualmie sub-basins are inseparable at this point, further providing justification for the basin diversion.

The proposed draft FIRM also indicates a revision to the project flood plain elevations, down from 185 in the current versions to elevation 184 to 182 in the draft version.

Core Requirement 2. Offsite Analysis

A level one-offsite analysis is required and is provided in the appendix of the Technical Information Report (TIR).

Core Requirement 3: Flow Control

The site lies in a level two flow control area. However, the entire site qualifies for exemptions as follows:

The Patterson Creek Basin portion qualifies for the Forested Open Space exemption number 5. This portion of the project is a rural residential project in the RA-5 and RA-10 Zone. 65% of the un-submerged drainage area will be dedicated in easements or tracts as Forested Open Space. BMP's such as roof and driveway dispersal will be used to accommodate drainage requirements on each of the Patterson Creek basin lots and any of the Snoqualmie Basin lots which cannot stub directly into the roadway storm drains.

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The Snoqualmie River Basin portion qualifies for the Direct Discharge exemption number 6. The site flow path from the project site to the edge of the 100-year floodplain is less than ¼ mile (portions of the site actually lie within the 100 year floodplain). The proposed conveyance systems will consist predominantly of pipes with some ditches, with capacity for the full-developed build out condition as well as existing undeveloped on-site tributary natural areas. Appropriate erosion protection measures will be used, such as rock lining of steeper channels. *See Section IV of the TIR for details.*

Core Requirement 4: Conveyance System

A conveyance analysis will be provided in Section V of the TIR for the construction document phase. The conveyance system will meet all applicable codes. Preliminary calculations are included herewith to justify the approximate size of the 42" diameter direct discharge pipe.

Core Requirement 5: Erosion and Sedimentation Control

Erosion Control Systems are required. Patterson Creek portions of the site are in a P suffix Zone and pertinent conditions apply per KCC 16.82.150D, specifically limiting construction to the March 31 thru Oct 1 period and limiting clearing to 60% of the site. *Specific ESC systems will be recommended in Section IX of the TIR and a separate ESC plan will be prepared for the Construction Document Phase. The ESC plan shall meet all applicable codes.*

Core Requirement 7: Financial Guarantees and Liability

Per paragraph 1 of KCSWM 1.2.7, financial guarantees will be required. A Bond Quantity worksheet will be provided for public and private improvements after first county review.

Core Requirement 8: Water Quality

The site lies in a Basic Water Quality area.

For the southerly Patterson Creek portion of the project, exemption number 3, Forested Open Space for Rural Residential Projects will apply (KCSWM pg. 1-50 to 1-51). Exemption #3 indicates that any proposed natural discharge area within a project is exempt provided:

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Per KCSM manual, PG 5-15, appendix C and Section 4.2.2, runoff dispersal can be used as an alternative method to accomplish water quality requirements, such that filtration through grass/pasture removes harmful pollutants. This approach will be applied to those portions of the Patterson Creek sub-basin that are not otherwise directly discharged to the Snoqualmie River.

Water Quality facilities in the Snoqualmie Basin (and those portions of the Patterson Creek sub-basin which are directly discharged to the Snoqualmie River) will consist of a wet pond in the lower 9 hole portion (i.e. northerly portion) of the project. A portion of this facility lies within the 100-year floodplain. Consequently, a compensating volume will be excavated from the hillside area near Tract A to create mitigation floodplain storage. Continuous Inflow Biofiltration swales are proposed along Snoqualmie River Road and Tall Chief Road (sta 47+00 to 62+00).

A copy of the current geotechnical review is attached in the appendix.

As noted above, roof downspout dispersal will be utilized for all buildings, as required. *Design details will be provided in section IV of the TIR for the Construction Document phase of the project.*

Special Requirement #1: Other adopted area-specific requirements.

Portions of the site are located in the Patterson Creek Drainage Basin. The site is shown as a level 2 flow control area and a Basic Water Quality treatment area. The Zoning designation lists P suffix conditions (see section IV for additional details).

Special Requirement #2: Floodplain/Floodway delineation

The project does contain a wetland and portions are within the 100-year floodplain. The floodplain has been established through the FEMA Flood Insurance Rate Map, and will be recorded on final construction documents. Preliminary floodplain locations are shown on the attached excerpts from the King County Imap web site.

Special Requirement #3: Flood Protection Facilities

The project involves no new flood protection facilities nor modifications to any existing ones. Therefore, this requirement does not apply to the site.

Special Requirement #4: Source Controls
The site is not a commercial, industrial nor multifamily project. Therefore, this requirement does not apply to the site.

I. PROJECT OVERVIEW

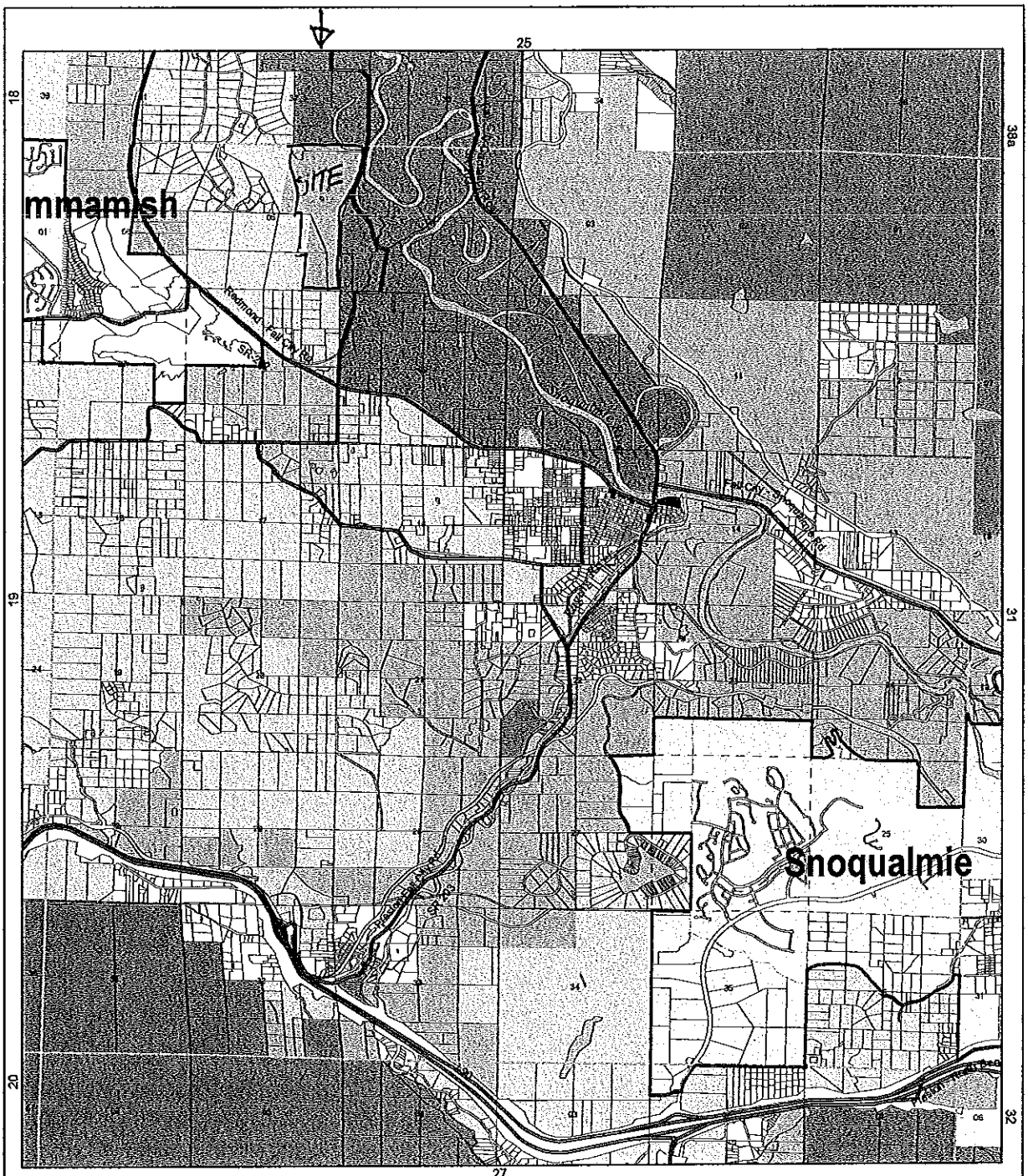
The Proposed Development includes platting 18 residential lots on the existing 191.2 acres, consisting of 4 separate tax parcels. Clustering will be used such that the northerly 9 holes of the existing 18-hole country club golf course will be reverted to agrarian or conservancy uses. Construction of a new Rural Minor access road (Tall Chief Road and Aldera Ridge Road) will provide the necessary access. Emergency Access will be provided via Campground Road. Existing Zoning is predominantly RA-10 with some RA-5-P. The site is located at 1313 West Snoqualmie River Road in un-incorporated King County, near Fall City, WA. Grading, utility and drainage improvements will be prepared in compliance with the current County Code based on the 1998 surface water manual.

The northerly ¾ of the site lies in the Snoqualmie River Basin, while the remainder lies in the Patterson Creek Basin. Grading, utility and drainage improvements will be prepared in compliance with the current County Code.

II. PRELIMINARY CONDITIONS SUMMARY

The property was, until recently, developed with an existing 18 whole Country Club Private Golf Course. Currently, the lower 9 hole Golf Course is still in place, but the upper 9 holes have been unused since around 2005. Forest covers the undeveloped hillside and a number of wetlands are located in the lower lying areas. Existing grades vary between very flat in the NE to beyond 40% along the hillside area. Soils are predominantly Nooksak silt loams in the valley floor and Alderwood series gravelly, sandy loams on the hillside. Both soils are till series soils. There is a small area of mixed alluvial soils identified in SCS mapping (included herein). The preliminary geotechnical report identifies thick lenses of gravelly sandy soils located in benches near the southwest portion of the project.

Site access is provided via a private road and easement adjoining West Snoqualmie River Road, which is classified as a Collector Arterial and currently improved to a rural shoulder and ditch system. Further road improvements are required to widen the existing access.



KING COUNTY ZONING ATLAS

Townships 24 Range 7

Includes zoning changes through Ordinance #14448 (August 2002)

- A-10 - Agricultural, one DU* per 10 acres
- A-35 - Agricultural, one DU* per 35 acres
- F - Forest
- M - Mineral
- RA-2.5 - Rural Area, one DU* per 2.5 acres
- RA-5 - Rural Area, one DU* per 5 acres
- RA-10 - Rural Area, one DU* per 10 acres
- UR - Urban Reserve, one DU* per 5 acres
- R-1 - Residential, one DU* per acre
- R-4 - Residential, 4 DU* per acre
- R-6 - Residential, 6 DU* per acre
- R-8 - Residential, 8 DU* per acre
- R-12 - Residential, 12 DU* per acre
- R-18 - Residential, 18 DU* per acre
- R-24 - Residential, 24 DU* per acre
- R-48 - Residential, 48 DU* per acre
- NB - Neighborhood Business
- CB - Community Business
- RB - Regional Business
- O - Office
- I - Industrial
- Incorporated City
- Urban Growth Area Boundary

N

0 0.15 0.3 0.6 0.9 Miles

This map shows only the base zoning for each parcel of property.

This map does not show special development conditions, such as P-suffix Conditions, Special District Overlays, or potential zoning that apply to many properties in King County.

This map is a general color representation of official zoning controls. Final decisions on any inconsistencies are based on the ordinance establishing the current zoning.

All property-specific development conditions are displayed on the official zoning control at the Department of Development and Environmental Services (DDES), 900 Oakesdale Ave SW, Renton, WA 98055, Telephone (206) 296-6600.

The atlas is produced by King County's Geographic Information System. Copies of this atlas are available for review or purchase at DDES. The atlas can be viewed on the Internet at: http://www.metrokc.gov/ddes/gis/zonenotes.htm

DU* = Dwelling Unit

King County

Map generated: Feb 6, 2003

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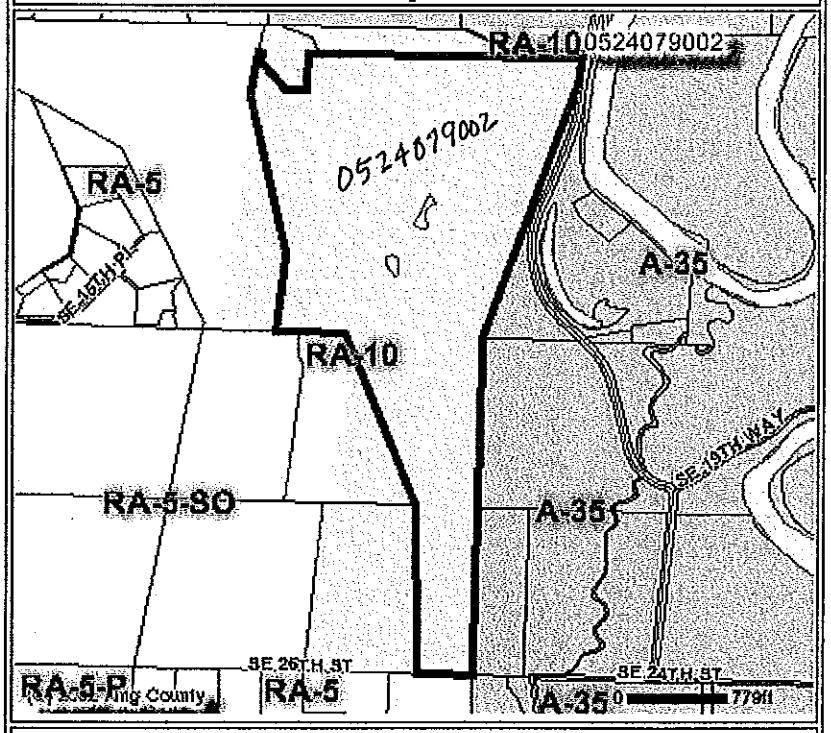
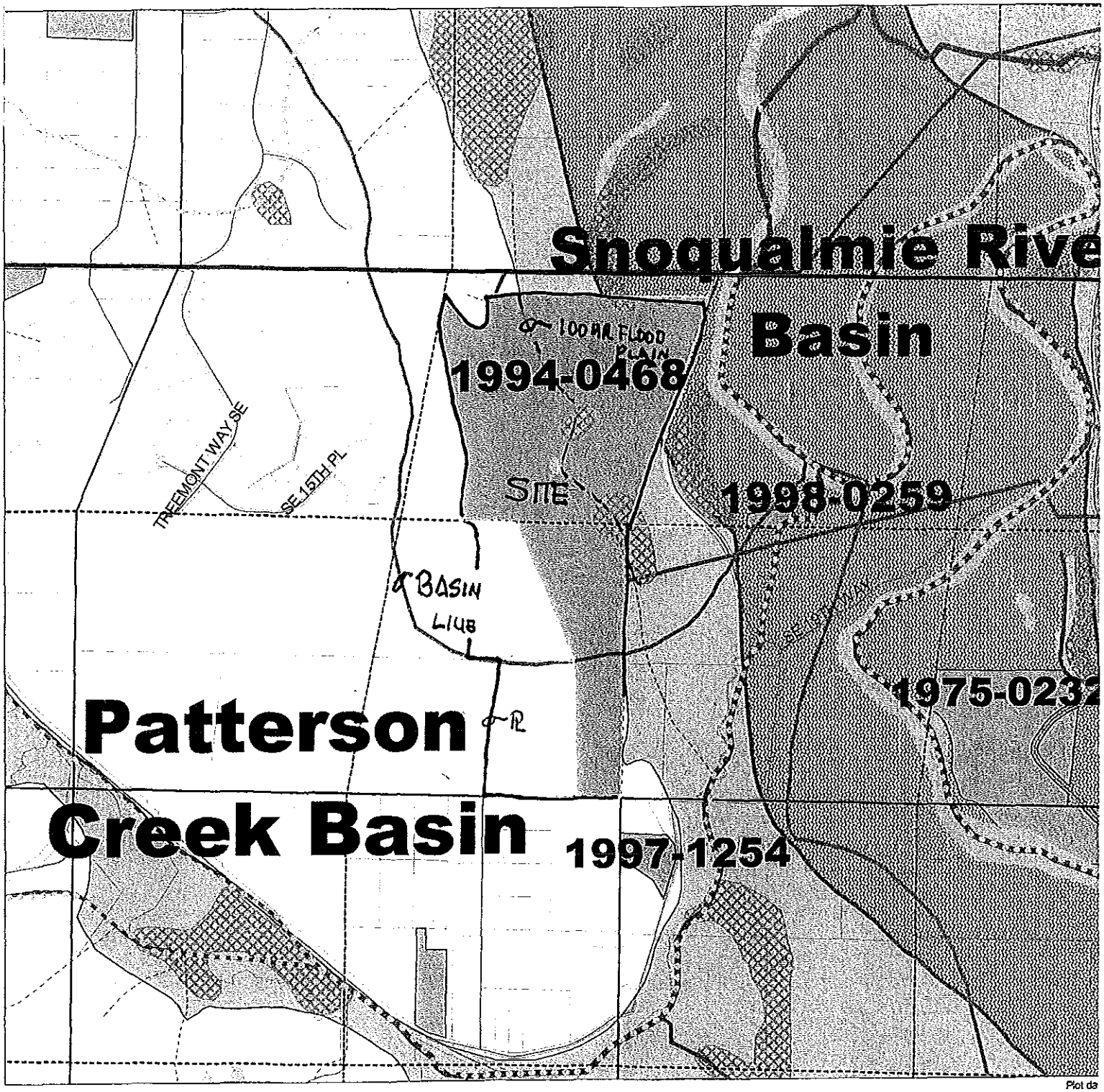
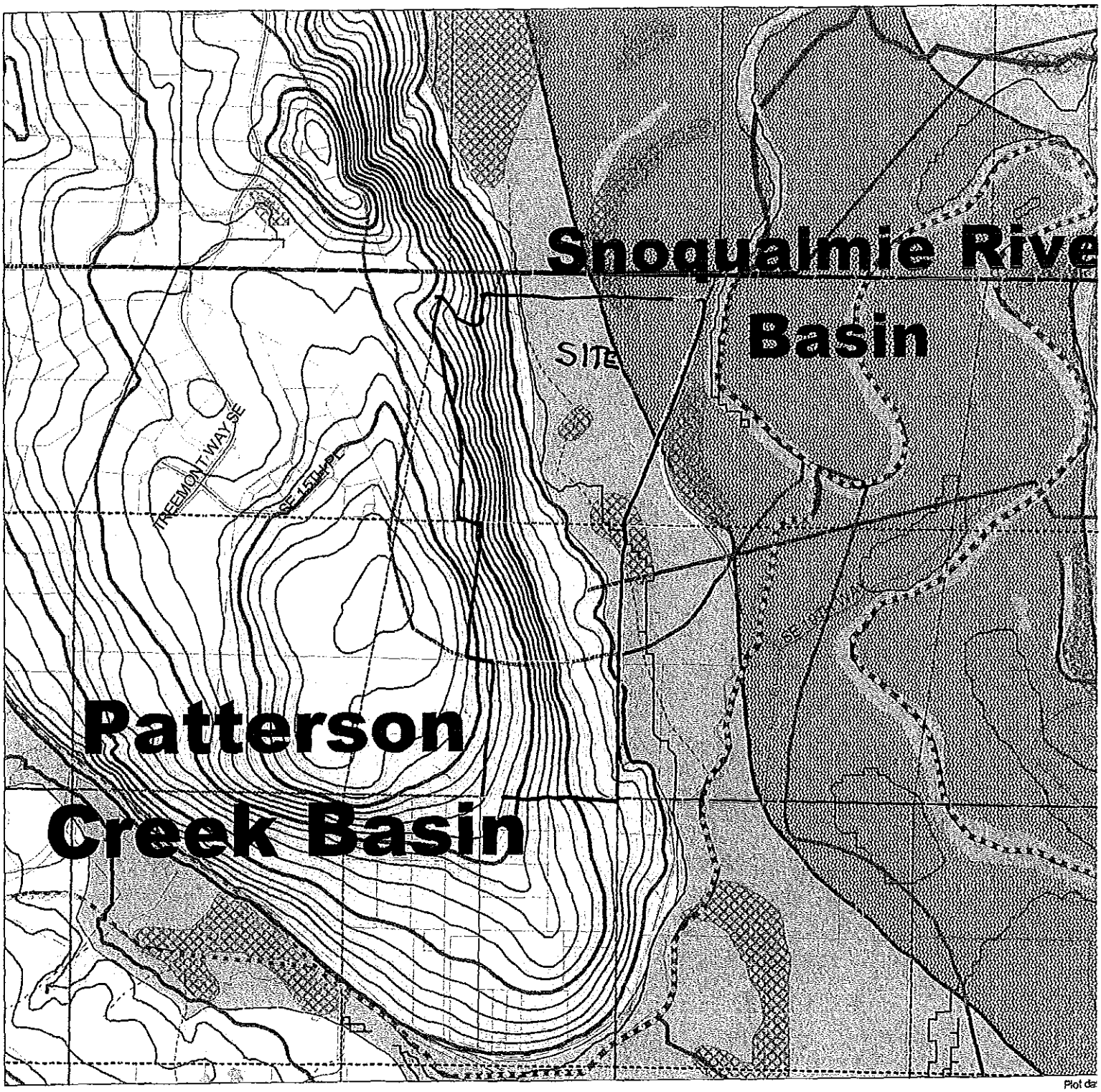
King County Home News Services Comments Search

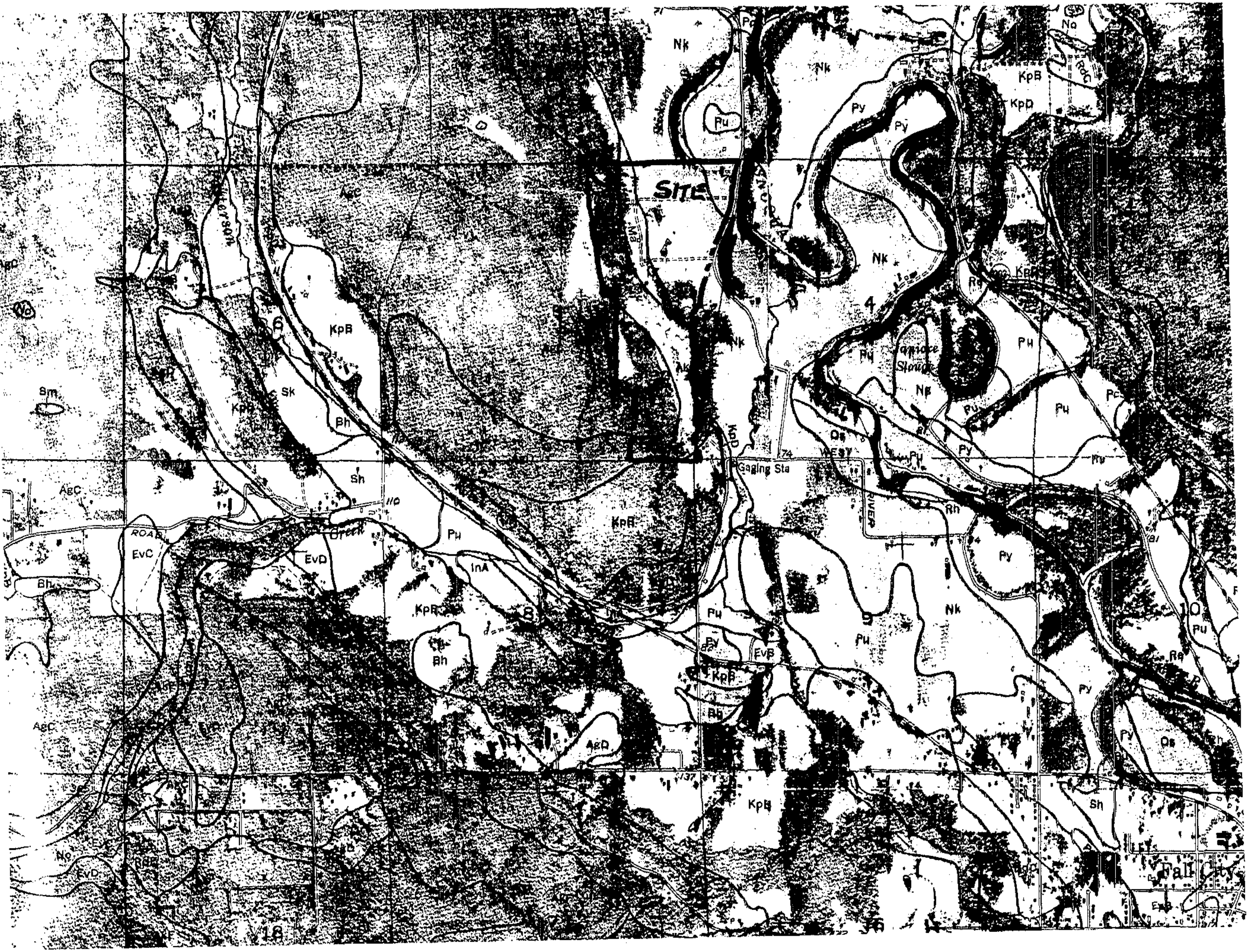
Parcel Map and Data



Parcel Number	0524079002
Address	1313 WEST SNOQUALMIE RIVER RD SE
Zipcode	98024
Taxpayer	TALL CHIEF GOLF INC


Snoqualmie Rive
Basin
100 YR FLOOD PLAIN
1994-0468
1998-0259
SITE
TREEMONT WAY SE
SE 15TH PL
BASIN
LIMB
1975-0232
Patterson
Creek Basin
1997-1254


Snoqualmie Rive
Basin
SITE
TREEMONT WAY SE
SE 145th PL
Patterson
Creek Basin


SITE
Gaging Sta
RIVER
Fall City
Nk
Py
Pu
KpB
KpD
Sk
Bh
Sh
EvC
EvD
EvB
InA
AgC
AgD
Sm
No
Rh
Re
Os

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, indicates the class of slope. Symbols without a slope letter are those of nearly level soils.

SYMBOL	NAME
AgB	Alderwood gravelly sandy loam, 0 to 6 percent slopes
AgC	Alderwood gravelly sandy loam, 6 to 15 percent slopes
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes
AkF	Alderwood and Kitsap soils, very steep
AmB	Arents, Alderwood material, 0 to 6 percent slopes *
AmC	Arents, Alderwood material, 6 to 15 percent slopes *
An	Arents, Everett material *
BeC	Beausite gravelly sandy loam, 6 to 15 percent slopes
BeD	Beausite gravelly sandy loam, 15 to 30 percent slopes
BeF	Beausite gravelly sandy loam, 40 to 75 percent slopes
Bh	Bellingham silt loam
Br	Briscot silt loam
Bu	Buckley silt loam
Cb	Coastal Beaches
Ea	Earlmont silt loam
Ed	Edgewick fine sandy loam
EvB	Everett gravelly sandy loam, 0 to 5 percent slopes
EvC	Everett gravelly sandy loam, 5 to 15 percent slopes
EvD	Everett gravelly sandy loam, 15 to 30 percent slopes
EwC	Everett-Alderwood gravelly sandy loams, 6 to 15 percent slopes
InA	Indianola loamy fine sand, 0 to 4 percent slopes
InC	Indianola loamy fine sand, 4 to 15 percent slopes
InD	Indianola loamy fine sand, 15 to 30 percent slopes
KpB	Kitsap silt loam, 2 to 8 percent slopes
KpC	Kitsap silt loam, 8 to 15 percent slopes
KpD	Kitsap silt loam, 15 to 30 percent slopes
KsC	Klaus gravelly loamy sand, 6 to 15 percent slopes
Ma	Mixed alluvial land
NeC	Neilton very gravelly loamy sand, 2 to 15 percent slopes
Ng	Newberg silt loam
Nk	Nooksack silt loam
No	Norma sandy loam
Or	Orcas peat
Os	Oridia silt loam
OvC	Ovall gravelly loam, 0 to 15 percent slopes
OvD	Ovall gravelly loam, 15 to 25 percent slopes
OvF	Ovall gravelly loam, 40 to 75 percent slopes
Pc	Pilchuck loamy fine sand
Pk	Pilchuck fine sandy loam
Pu	Puget silty clay loam
Py	Puyallup fine sandy loam
RaC	Ragnar fine sandy loam, 6 to 15 percent slopes
RaD	Ragnar fine sandy loam, 15 to 25 percent slopes
RdC	Ragnar-Indianola association, sloping *
RdE	Ragnar-Indianola association, moderately steep *
Re	Renton silt loam
Rh	Riverwash
Sa	Salal silt loam
Sh	Sammamish silt loam
Sk	Seattle muck
Sm	Shalcar muck
Sn	Si silt loam
So	Snohomish silt loam
Sr	Snohomish silt loam, thick surface variant
Su	Sultan silt loam
Tu	Tukwila muck
Ur	Urban land
Wo	Woodinville silt loam

TABLE 3.2.2.B EQUIVALENCE BETWEEN SCS SOIL TYPES AND KCRTS SOIL TYPES

SCS Soil Type	SCS Hydrologic Soil Group	KCRTS Soil Group	Notes
Alderwood (AgB, AgC, AgD)	C	Till	
Arents, Alderwood Material (AmB, AmC)	C	Till	
Arents, Everett Material (An)	B	Outwash	1
Beausite (BeC, BeD, BeF)	C	Till	2
Bellingham (Bh)	D	Till	3
Briscot (Br)	D	Till	3
Buckley (Bu)	D	Till	4
Earlmont (Ea)	D	Till	3
Edgewick (Ed)	C	Till	3
Everett (EvB, EvC, EvD, EwC)	A/B	Outwash	1
Indianola (InC, InA, InD)	A	Outwash	1
Kitsap (KpB, KpC, KpD)	C	Till	
Klaus (KsC)	C	Outwash	1
Neilton (NeC)	A	Outwash	1
Newberg (Ng)	B	Till	3
Nooksack (Nk)	C	Till	3
Norma (No)	D	Till	3
Orcas (Or)	D	Wetland	
Oridia (Os)	D	Till	3
Ovall (OvC, OvD, OvF)	C	Till	2
Pilchuck (Pc)	C	Till	3
Puget (Pu)	D	Till	3
Puyallup (Py)	B	Till	3
Ragnar (RaC, RaD, RaC, RaE)	B	Outwash	1
Renton (Re)	D	Till	3
Salal (Sa)	C	Till	3
Sammamish (Sh)	D	Till	3
Seattle (Sk)	D	Wetland	
Shalcar (Sm)	D	Till	3
Si (Sn)	C	Till	3
Snohomish (So, Sr)	D	Till	3
Sultan (Su)	C	Till	3
Tukwila (Tu)	D	Till	3
Woodinville (Wo)	D	Till	3

Notes:

1. Where outwash soils are saturated or underlain at shallow depth (<5 feet) by glacial till, they should be treated as till soils.
2. These are bedrock soils, but calibration of HSPF by King County DNR shows bedrock soils to have similar hydrologic response to till soils.
3. These are alluvial soils, some of which are underlain by glacial till or have a seasonally high water table. In the absence of detailed study, these soils should be treated as till soils.
4. Buckley soils are formed on the low-permeability Osceola mudflow. Hydrologic response is assumed to be similar to that of till soils.

III. OFF-SITE ANALYSIS (DOWNSTREAM DRAINAGE ANALYSIS)

See Appendix

IV. PROPOSED DRAINAGED IMPROVEMENTS

The site lies in a level two flow control area. However, the entire site qualifies for exemptions as follows:

The Patterson Creek Basin portion qualifies for the Forested Open Space exemption number 5. This portion of the project is a rural residential project in the RA-5 and RA-10 Zone. 65% of the un-submerged drainage area will be dedicated in easements or tracts as Forested Open Space. BMP's such as roof and driveway dispersal will be used to accommodate drainage requirements on each of the Patterson Creek basin lots and any of the Snoqualmie Basin lots which cannot stub directly into the roadway storm drains.

Roof drain dispersal will largely rely on the splash block method, with 50' min. vegetated flow paths between the roof and any structure or property line. Road dispersal for the driveways will rely partially on sheet flow and where concentrated flows result from roadway cut ends or uphill ditch systems, direct discharges to rock pads with ~~100~~ foot flow paths thru vegetation will be allowed where 100 year flows are less than 0.2cfs. Dispersion trenches will be used otherwise, such that any 50' dispersion trench receives no more than 0.5 cfs in the 100-year event. In compliance with the geotechnical report recommendations, emphasis is placed on collecting runoff from the hillside bench area and discharging it to the valley floor in an effort to avoid erosion and instability. To facilitate this, a French drain is proposed at approximate elevation 330 along lots 13 thru 16. Extensive sub-basin delineation and modeling will be provided at the construction document phase.

Approximately 21.0 acres of the Patterson Creek Basin will be diverted northwards along proposed Tall Chief Road and ultimately directly discharged to the Snoqualmie River along with those portions of the project that lie in the Snoqualmie River Basin. A SWM Drainage Adjustment application is made for this purpose. The diversion will further allow the removal of drainage from the hillside to avoid erosion and instability for the benefit of the project. It is assumed that a geohydrologic report must be prepared to show that there are no surficial or interflow aquifers present which might otherwise affect the Patterson Creek base flows. However, given that the Patterson sub basin is the lowest portion of the basin prior to confluence with the Snoqualmie River, we have assumed this conclusion is highly likely.

The Snoqualmie River Basin portion qualifies for the Direct Discharge exemption number 6. The site flow path from the project site to the edge of the 100-year floodplain is less than ¼ mile (portions of the site actually lie within the 100 year floodplain). The proposed conveyance systems will consist predominantly of pipes with some ditches, with capacity for the full-developed build out condition as well as existing undeveloped on-site tributary natural areas. Appropriate erosion protection measures will be used, such as rock lining of steeper channels.

The site lies in a Basic Water Quality area.

For the southerly Patterson Creek portion of the project, exemption number 3, Forested Open Space for Rural Residential Projects will apply (KCSWM pg. 1-50 to 1-51). Exemption #3 indicates that any proposed natural discharge area within a project is exempt provided:

2. At least 65% of the unsubmerged portion of the natural discharge area is set aside as forested open space as specified in Section 5.2.1 and
2. The runoff from roads and driveways is dispersed through at least 100 feet of native vegetation (per 5.2.1) and
4. The runoff from continuous lawn areas of 1 acre or more is dispersed through at least 25 feet of native vegetation onsite per 1.2.8.2 (P-1-57).

Per KCSM manual, PG 5-15, appendix C and Section 4.2.2, runoff dispersal can be used as an alternative method to accomplish water quality requirements, such that filtration through grass/pasture removes harmful pollutants. This approach will be applied to those portions of the Patterson Creek sub-basin that are not otherwise directly discharged to the Snoqualmie River.

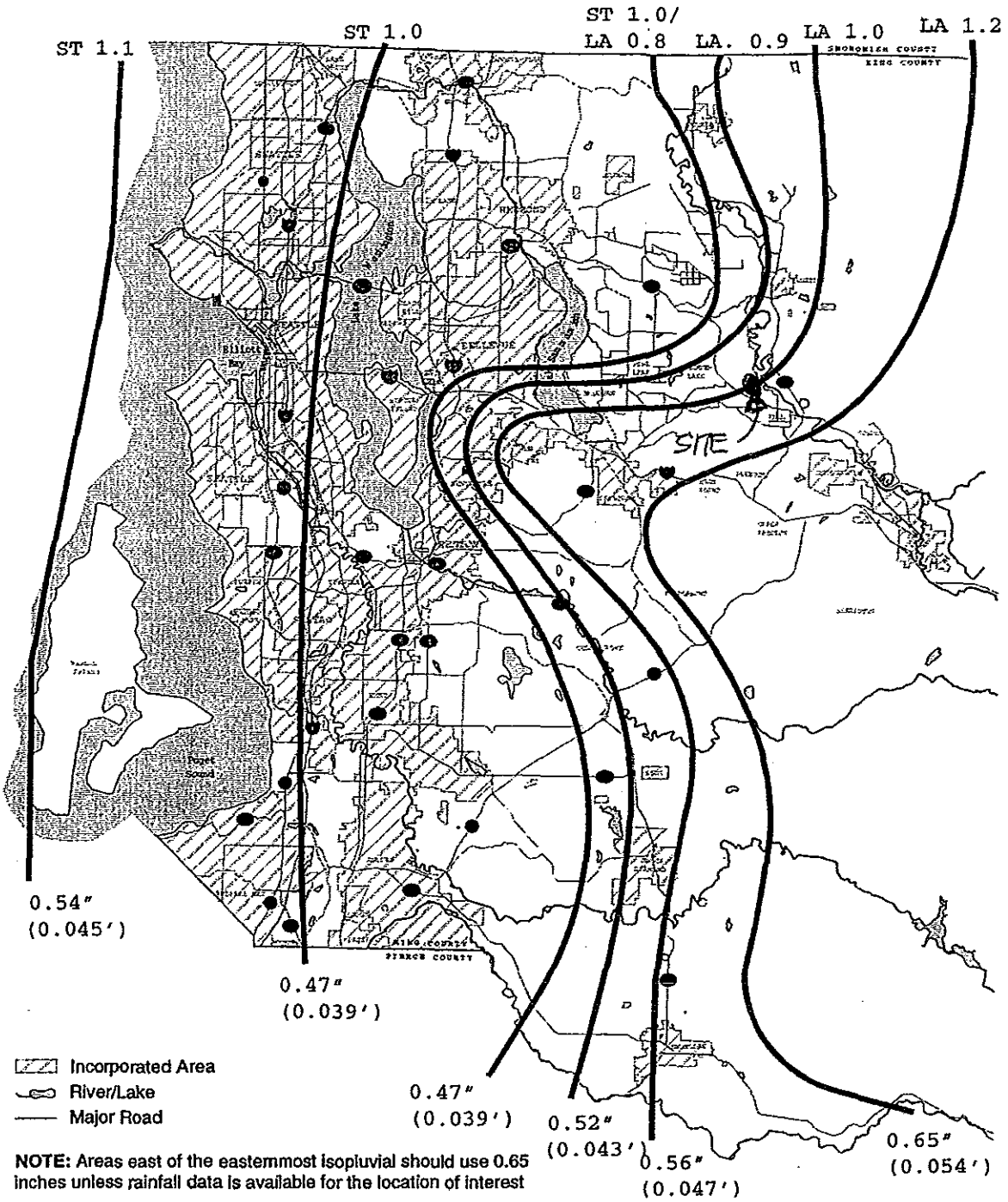
Water Quality facilities in the Snoqualmie Basin (and those portions of the Patterson Creek sub-basin which are directly discharged to the Snoqualmie River) will consist of a wet pond in the lower 9 hole portion (i.e. northerly portion) of the project. A portion of this facility lies within the 100-year floodplain. Consequently, a compensating volume will be excavated from the hillside area near Tract A to create mitigation floodplain storage.

A copy of the current geotechnical review is attached in the appendix.

As noted above, roof downspout dispersal will be utilized for all buildings, as required

One other very important feature in our project is the density (0.09 lots/ac or 10.6 ac/lot) with the limitation on clearing we would be clearing a maximum of 39.14 acres or 20% of our 191.2 acre site (assuming 65% open space on Patterson Basin lots and 80% max clearing on remaining lots per RA-5 zoning code).

FIGURE 6.4.1.A PRECIPITATION FOR MEAN ANNUAL STORM IN INCHES (FEET)



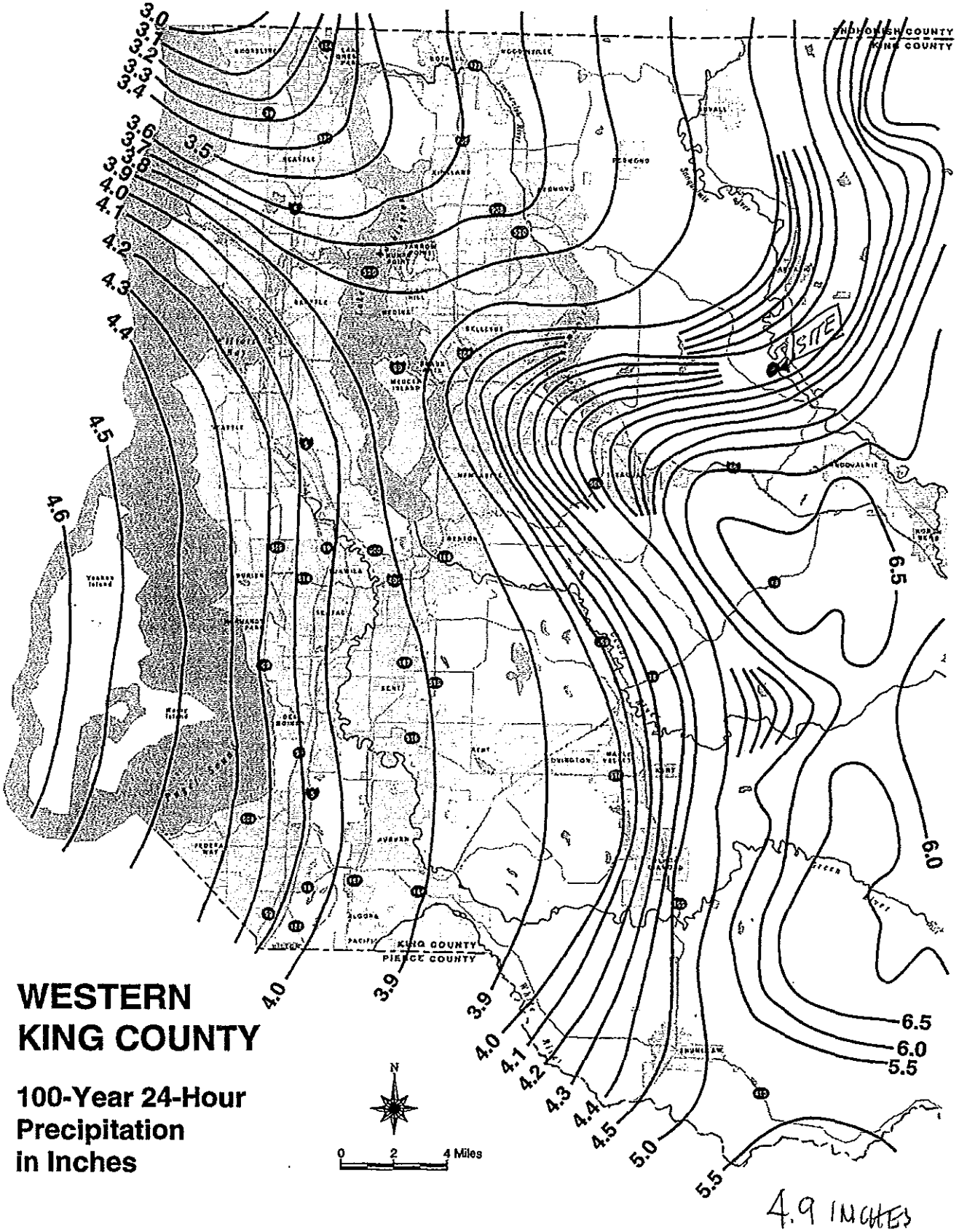
NOTE: Areas east of the easternmost isopluvial should use 0.65 inches unless rainfall data is available for the location of interest

[24] The mean annual storm is a conceptual storm found by dividing the annual precipitation by the total number of storm events per year

result, generates large amounts of runoff. For this application, till soil types include Buckley and bedrock soils, and alluvial and outwash soils that have a seasonally high water table or are underlain at a shallow depth (less than 5 feet) by glacial till. U.S. Soil Conservation Service (SCS) hydrologic soil groups that are classified as till soils include a few B, most C, and all D soils. See Chapter 3 for classification of specific SCS soil types.

0.56" ✓

FIGURE 3.2.1.D 100-YEAR 24-HOUR ISOPLUVIALS



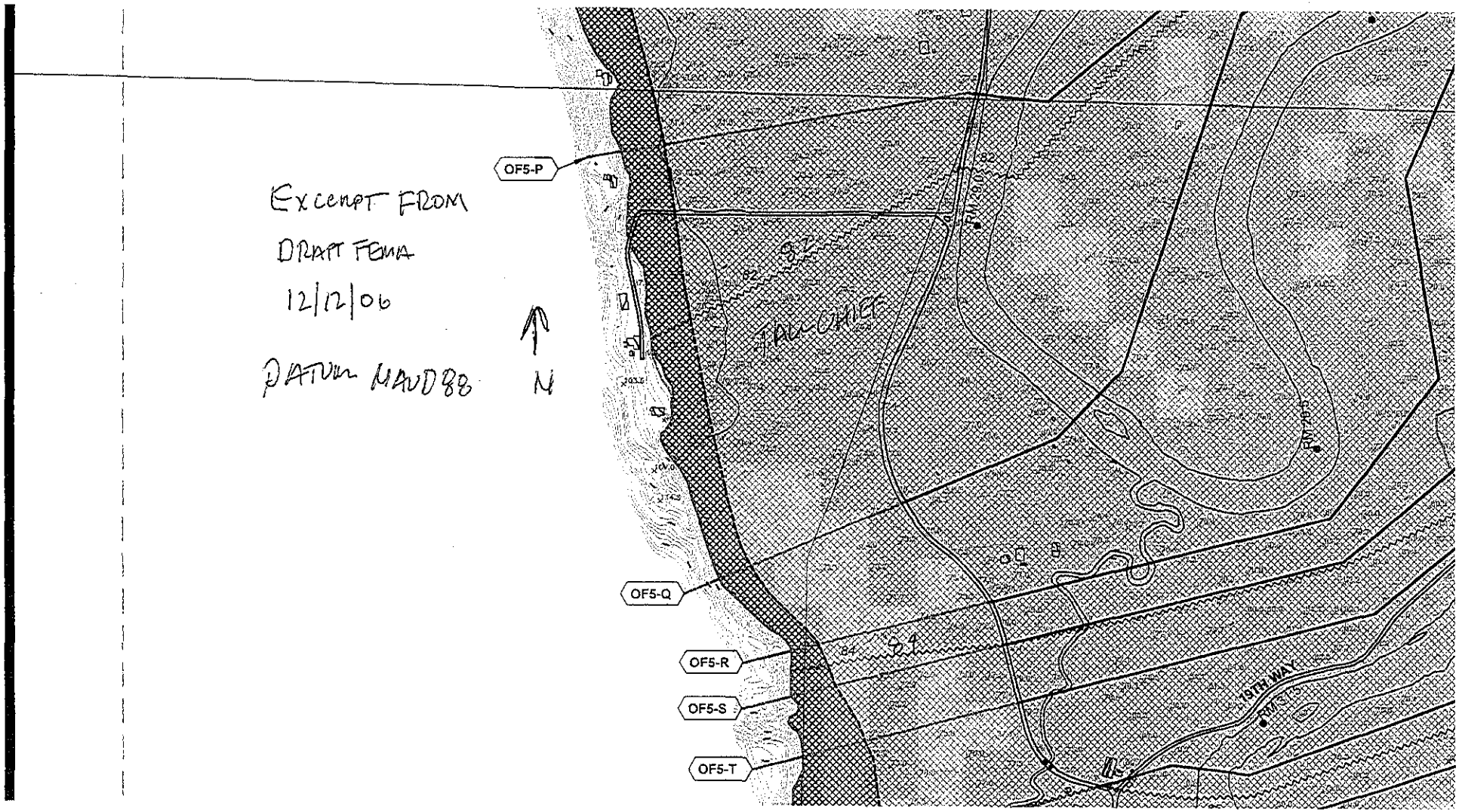
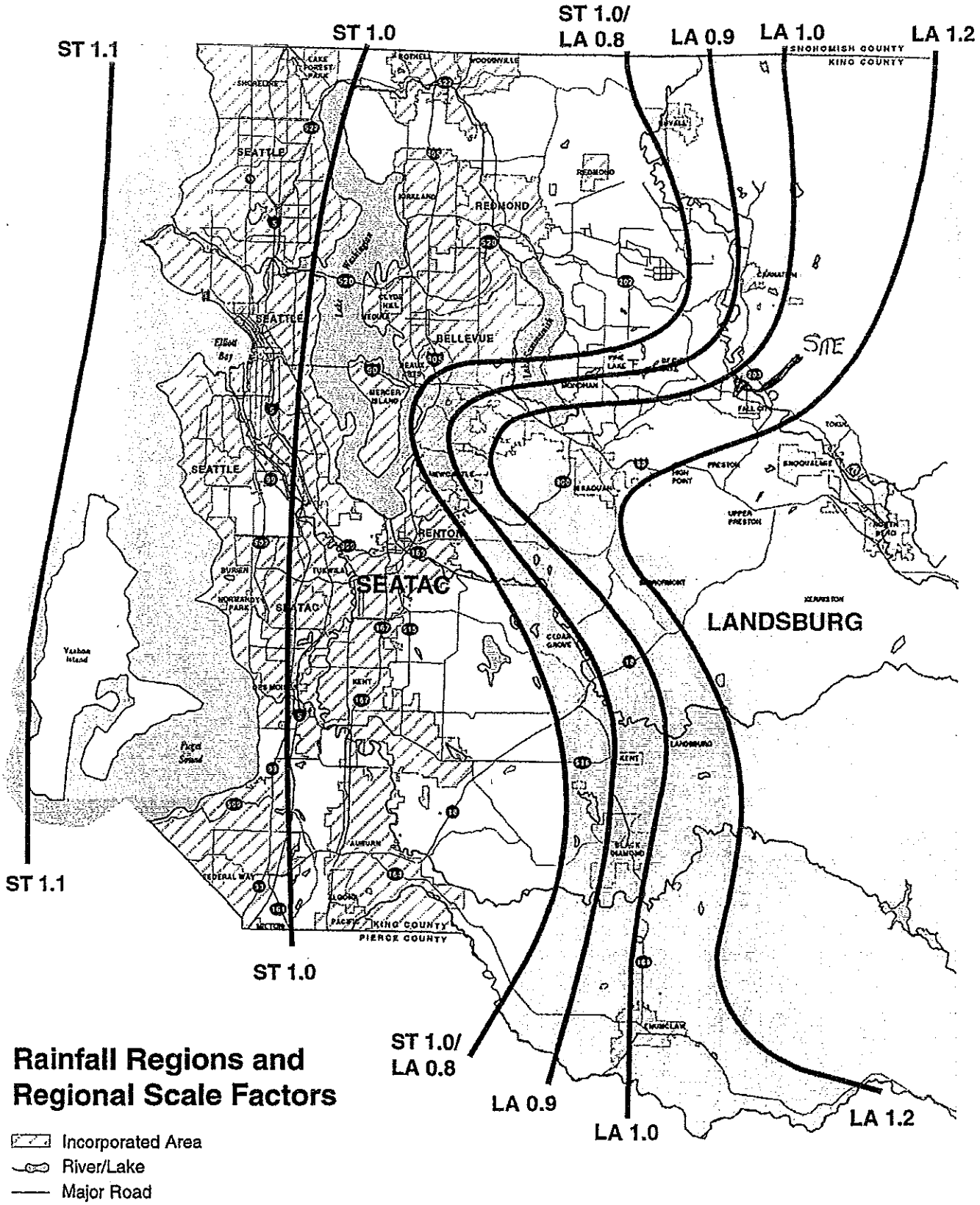

EXCERPT FROM
DRAFT FEMA
12/12/06
DATUM NAVD88
N
OF5-P
OF5-Q
OF5-R
OF5-S
OF5-T
S2
S1
FALL CREEK
19TH WAY

FIGURE 3.2.2.A RAINFALL REGIONS AND REGIONAL SCALE FACTORS



TR-55 CHECK | PRELIM DETENTION DESIGN | 5-18-09

Premise: Assume appellants successfully force project to provide detention in lieu of direct discharge.

- Assume all Patterson Creek Lots AND all Shop Basin Lots have 65% open space and are detention exempt.
- Design vested to 1998 KCSWDM.
- Site is Level 2 Flow control/Basic W.Q. Area.
- Soils Class C Till (Ag & Mk)
- Regional Scale Factor is LA 1.0.
- Hourly Time Steps.

STATISTICS FOR WETPOND & DETENTION DEVELOPED CONDITION

BASIN	IMPERV ROADS	IMPERV ROOF & DW	PERV LAWNS	PERV FOREST	# BLDG LOTS	TOTAL AREA
		(*)				
A	3.00 Ac	29.5 Ac of LOTS X20% = 5.9 Ac X50% credit = 2.95	29.5K 15% = 4.4 +2.95 = 7.35	Remainder 51.5 Ac	9	64.84 Ac
B	2.37 Ac	15.2 Ac of LOTS X20% = 3.04 X50% credit = 1.52	15.2 X 15% = 2.3 +1.52 = 3.8	Remainder 13.29 Ac	3	21.0 Ac
F OFFSITE	0.6 Ac	6 Ac LOTS X20% = 1.2 Ac X 50% credit = 0.6	6 X 15% = 0.9 + 0.6 = 1.5	Remainder 11.5 Ac	2 offsite	14.2 Ac
E				41.75		41.75
Sub-totals for wetpond & direct discharge Design	5.97	5.07	12.65	118.05		141.79

WETPOND DESIGN Pg 68-80 - chpt 6

f = 3 wetpond factor

R = ppt for mean Annual storm (Fig 6.4.1.A) = 0.56"

$V_R = 0.9A_I + 0.25A_{TG} + 0.1A_{TF} + 0.01A_O \times R/12 \times 43560$

$= 0.9(5.97+5.07) + 0.25(12.65) + 0.1(118.05) \times 0.56/12 \times 43560 = 50,624$

V_b = Volume reqd for wetpond = $V_R \times 3 = 151,871$ CF

(*) Note: per KCSWDM 5.2.2 - Roof infiltrate are modeled as 100% grass versus 50% credit taken here.

x MAX IMPERV = 20% (RA-5 ZONE)

TALL CHIEF	PRELIM DETENTION DESIGN	5-18-09

EXIST CONDITIONS

NOTE - MAYBE USE 15% FOREST 55% GRASS, 15% IMPERV - DES SWM pg 5-35

BASIN	IMPERV ROADS	IMPERV ROOF & DW	PERV LAWNS	PERV FOREST	TOTAL
A	0.55AC	0.4AC	14.3	49.59	64.84
B	⊖	⊖	⊖	21.0	21.0
F	0.6	0.6	1.5	11.5	14.2
E				41.75	41.75
	1.15	1	15.8	123.84	141.79

CONCLUSION

WET POND VOL REQD - 151,871 CF

DETENTION REQD PER SPREADSHEET - 187,657 CF } 339529

POND EL	AREA	VOLUME TOTAL
374	N 120 SF	⊖
378	19,612 SF	61,469
378	20,000 SF	61469
383	33298 SF	194684
385	38839	267400
387	44528	351,843

▽ WET POND EL 381.39

FP @ EL 82

APPOX MAX WS 100YR 85.4

CURRENT FEMA FIRM # 53033C0710G REVISED MAY 2006
& 0709G

SHOWS FP @ EL 80 NGVD @ POND SITE - CONFIRM W/ SURVEYOR.
NOTE - LEFT MESSAGE W/ DOUG HANSEN 5-27-09.

NOTE FP @ EL 82 USING DATUM PER SURVEYOR.

NOTE - PER SWM, VOL < 10 AC FT, PROJECT IS EXEMPT FROM DAM COMPLIANCE (DES SWM pg 5-17)

Pondcalc Worksheet

Instructions:

1 Enter site information in the yellow highlighted cells
2 Verify no error message is displayed
3 Results are displayed in Green Box

*Note: pondcalc will not work for negative landcover conversions.
pondcalc does not handle existing EI or TG very well.

Disclaimer: This spreadsheet is provided without warranty of any kind. Use this spreadsheet at your own risk. All facility sizes should be verified using KCRTS software.

Rainfall Region	LA	{either ST or LA see rainfall regions map}
Scale Factor:	1.00	{ 0.8 - 1.2 see rainfall regions map}
FC Level:	2	{ 1, 2, or 3 see flow control app map}

Predeveloped acres	Landcover type	Postdeveloped acres	Adjusted Acres converted cover	Error Messages
123.84	TF	[illegible]	9.03	
	TP		0	
[illegible]	TG	15.85	0	
	EI	11.14	8.99	

TF= till forest, TP = till pasture, TG = till grass, EI = effective impervious

Acreage Check:	post	pre	
gross	141.8	141.8	**PreDev Acreage Greater than PostDev**
adjusted	8.99	9.03	**PreDev Acreage Greater than PostDev**

Storage Estimate
5.8 inches per converted acre
0.4 inches per gross acre
4.3 ac-ft
187,657 cubic ft

DIRECT DISCHARGE SYSTEM

SCALE FACTOR LANDSBORO 1.0

KERRS 15 MIN TIME STEP FOR CONVERGENCE

SOILS - GROUP C TILL (CROOKSACK & ALPERWOOD)

FOR BASINS A & B

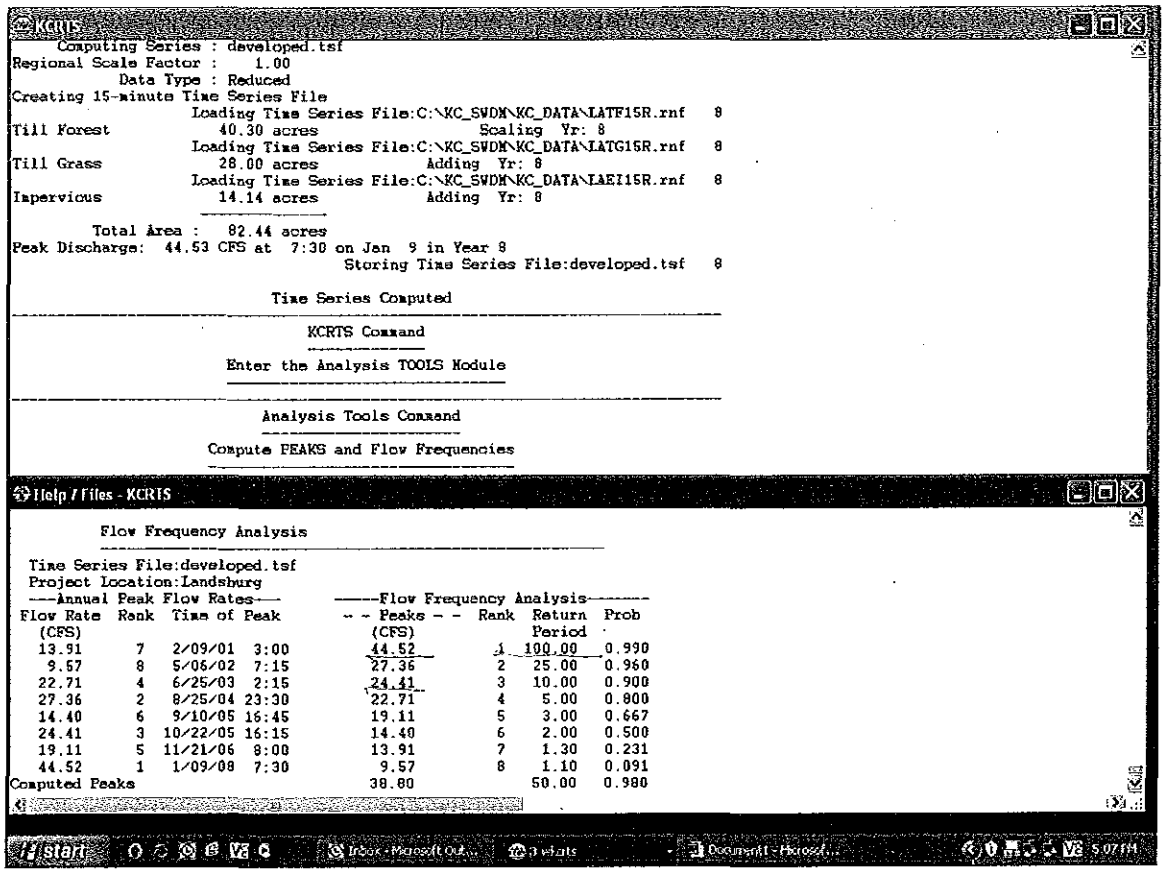
100YR ϕ = 44.5 CFS , ϕ10 = 24.41

DESIGN CONVEYANCE FOR 100YR + 30% = 44.5 X 1.3 = 58 CFS

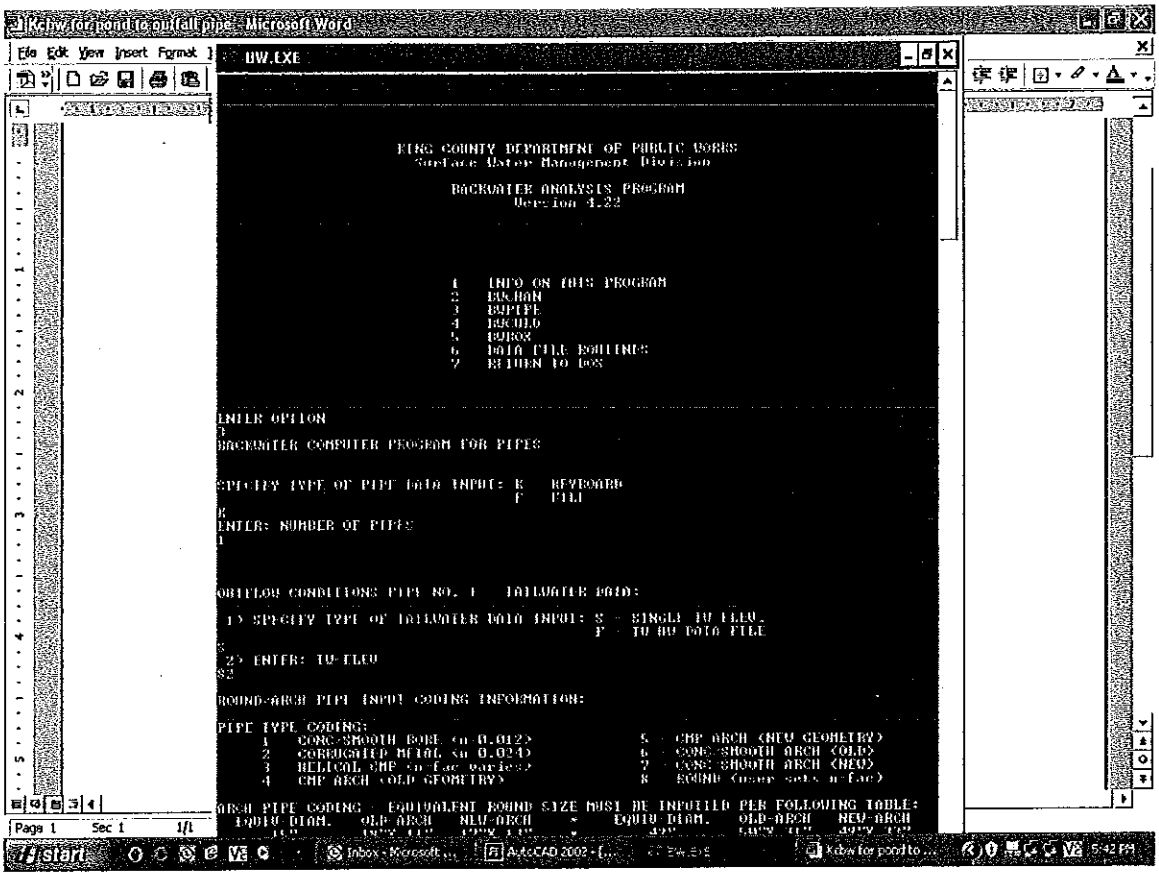
USE 42" ϕ M-12 @ S = 0.3% , vel = 6 fps

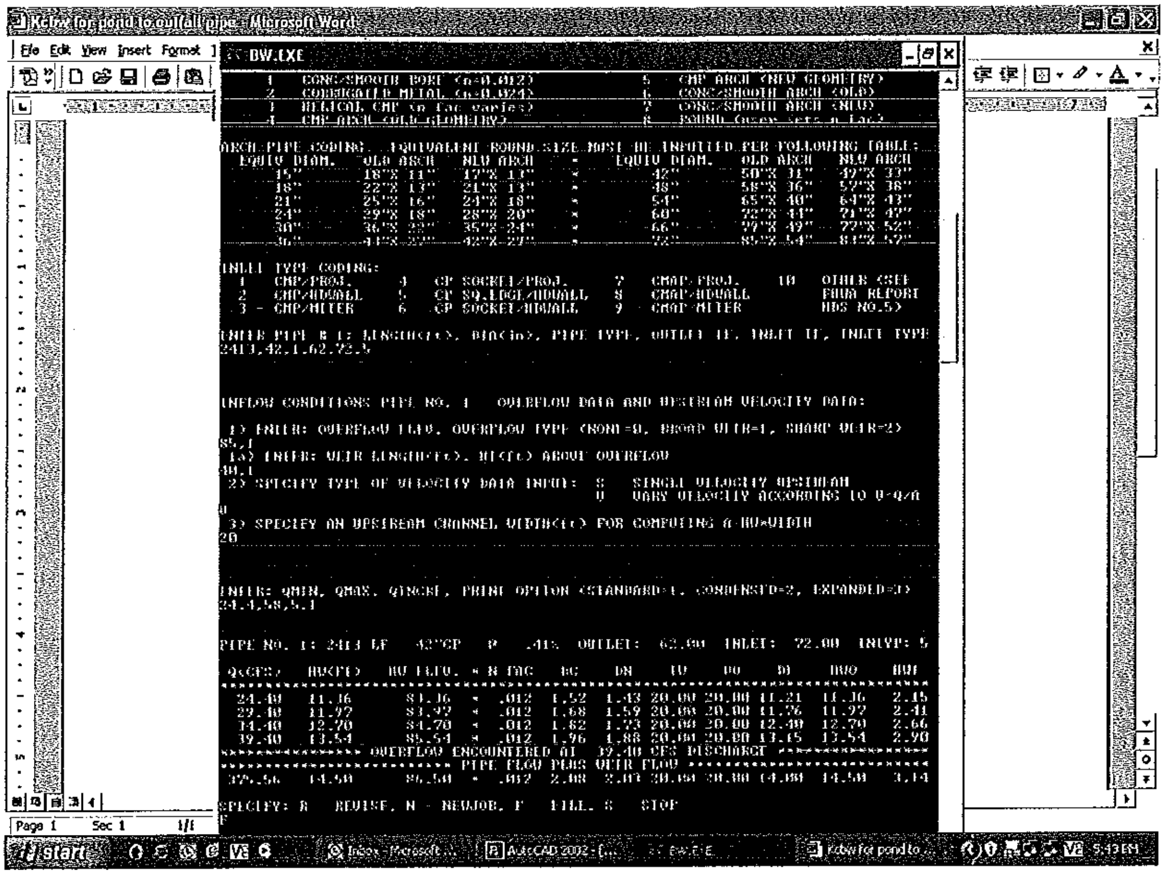
LENGTH = 7143 LF

HL ANALYSIS PER ATTACHED KCBW.


KCRTS
Computing Series : developed.tsf
Regional Scale Factor : 1.00
Data Type : Reduced
Creating 15-minute Time Series File
Loading Time Series File:C:\KC_SWDM\KC_DATA\LATF15R.rnf 8
Till Forest 40.30 acres Scaling Yr: 8
Loading Time Series File:C:\KC_SWDM\KC_DATA\LATG15R.rnf 8
Till Grass 28.00 acres Adding Yr: 8
Loading Time Series File:C:\KC_SWDM\KC_DATA\LAEI15R.rnf 8
Impervious 14.14 acres Adding Yr: 8
Total Area : 82.44 acres
Peak Discharge: 44.53 CFS at 7:30 on Jan 9 in Year 8
Storing Time Series File:developed.tsf 8
Time Series Computed
KCRTS Command
Enter the Analysis TOOLS Module
Analysis Tools Command
Compute PEAKS and Flow Frequencies
Help / Files - KCRTS
Flow Frequency Analysis
Time Series File:developed.tsf
Project Location:Landsburg
---Annual Peak Flow Rates--- -----Flow Frequency Analysis-------
Flow Rate (CFS) Rank Time of Peak -- - Peaks - - (CFS) Rank Return Period Prob
13.91 7 2/09/01 3:00 44.52 1 100.00 0.990
9.57 8 5/06/02 7:15 27.36 2 25.00 0.960
22.71 4 6/25/03 2:15 24.41 3 10.00 0.900
27.36 2 8/25/04 23:30 22.71 4 5.00 0.800
14.40 6 9/10/05 16:45 19.11 5 3.00 0.667
24.41 3 10/22/05 16:15 14.40 6 2.00 0.500
19.11 5 11/21/06 8:00 13.91 7 1.30 0.231
44.52 1 1/09/08 7:30 9.57 8 1.10 0.091
Computed Peaks 38.80 50.00 0.980
start
Inbox - Microsoft Out...
3 KCRTS
Document1 - Microsof...
5:07 PM

Kcbw for pond to outfall pipe, tall chief, 12/12/06
TW Elev 82 in River, overflow wier @ pond @ elev 85, overflow occurs @ Q=39 CFS (which is approx 100 yr flow of 44 cfs),





```
BW.EXE
   1    CONC/SMOOTH BORE (n=0.012)                   5    CMP ARCH (NEW GEOMETRY)
   2    CORRUGATED METAL (n=0.024)                   6    CONC/SMOOTH ARCH (OLD)
   3    HELICAL CMP (n fac varies)                   7    CONC/SMOOTH ARCH (NEW)
   4    CMP ARCH (OLD GEOMETRY)                      8    ROUND (user sets n fac)

ARCH PIPE CODING.  EQUIVALENT ROUND SIZE MUST BE INPUTTED PER FOLLOWING TABLE:
  EQUIV DIAM.   OLD ARCH   NEW ARCH    *    EQUIV DIAM.   OLD ARCH   NEW ARCH
     15"        18"X 11"   17"X 13"    *       42"        50"X 31"   49"X 33"
     18"        22"X 13"   21"X 15"    *       48"        58"X 36"   57"X 38"
     21"        25"X 16"   24"X 18"    *       54"        65"X 40"   64"X 43"
     24"        29"X 18"   28"X 20"    *       60"        72"X 44"   71"X 47"
     30"        36"X 22"   35"X 24"    *       66"        79"X 49"   77"X 52"
     36"        43"X 27"   42"X 27"    *       72"        85"X 54"   83"X 57"

INLET TYPE CODING:
  1   CMP/PROJ.       4   CP SOCKET/PROJ.      7   CMAP/PROJ.     10   OTHER (SEE
  2   CMP/HDWALL      5   CP SQ.EDGE/HDWALL    8   CMAP/HDWALL         FHWA REPORT
  3 - CMP/MITER       6   CP SOCKET/HDWALL     9   CMAP/MITER          HDS NO.5)

ENTER PIPE # 1: LENGTH(ft), DIA(in), PIPE TYPE, OUTLET IE, INLET IE, INLET TYPE
2413,42,1,62,72,5


INFLOW CONDITIONS PIPE NO. 1    OVERFLOW DATA AND UPSTREAM VELOCITY DATA:

 1) ENTER: OVERFLOW ELEV, OVERFLOW TYPE (NONE=0, BROAD WEIR=1, SHARP WEIR=2)
85,1
 1a) ENTER: WEIR LENGTH(ft), H(ft) ABOVE OVERFLOW
40,1
 2) SPECIFY TYPE OF VELOCITY DATA INPUT:  S    SINGLE VELOCITY UPSTREAM
                                          V    VARY VELOCITY ACCORDING TO V=Q/A
V
 3) SPECIFY AN UPSTREAM CHANNEL WIDTH(ft) FOR COMPUTING A=HW*WIDTH
20


ENTER: QMIN, QMAX, QINCRE, PRINT OPTION (STANDARD=1, CONDENSED=2, EXPANDED=3)
24.4,58,5,1

PIPE NO. 1: 2413 LF   42"CP   @   .41%  OUTLET:  62.00  INLET:  72.00  INTYP: 5

 Q(CFS)   HW(FT)   HW ELEV.  * N FAC   DC    DN    TW    DO    DI    HWO    HWI
***********************************************************************************
  24.40   11.16     83.16   *  .012   1.52  1.43 20.00 20.00 11.21  11.16   2.15
  29.40   11.97     83.97   *  .012   1.68  1.59 20.00 20.00 11.76  11.97   2.41
  34.40   12.70     84.70   *  .012   1.82  1.73 20.00 20.00 12.40  12.70   2.66
  39.40   13.54     85.54   *  .012   1.96  1.88 20.00 20.00 13.15  13.54   2.90
**************** OVERFLOW ENCOUNTERED AT   39.40 CFS DISCHARGE ******************
************************** PIPE FLOW PLUS WEIR FLOW *****************************
 379.56   14.50     86.50   *  .012   2.08  2.03 20.00 20.00 14.00  14.50   3.14

SPECIFY: R - REVISE, N - NEWJOB, F - FILE, S - STOP
F
```

TALL CHIEF | 1/9/08 HEH
Revised 7/15/09

FLOODPLAIN FILL ASSESSMENT & COMPENSATING EXCAVATION

— (TALL CHIEF ROAD)
ENTRY ROAD - FROM STATION 47+00 TO 62+50 (END)

TAKEN FROM CADD GENERATED VOLUMES & SECTIONS - SEE PLANS. SHEET P-4

	CUMULATIVE CUT	CUMULATIVE FILL
STATION 46+00	14012.64 CY	6567.26 CY
STATION 62+50	14603.39	7314.43
DELTA Δ	591 CY CUT	747 CY. FILL

THEREFORE, TOTAL ENTRY ROAD REQD. FLOODPLAIN COMP = 747-591 = 156 CY.

— WETPOND = SEE EXHIBIT S3 FOR DISPLACED VOLUME GRAPHIC SOLUTION.

VOLUME = 95,000 CF = 3,518 CY

TOTAL COMPENSATION VOL REQD = 156 CY + 3,518 CY = 3,674 CY
95,000 CF REQ'D PLUS LOSS FOR POND & BERM + 156 CY = 99,198 CF

★ - MITIGATION PROVIDED NEAR TALL CHIEF ROAD STATION 42+00 TO 47+00

MITIGATION AREA = (24,461) SF, AVE DEPTH = 4.1', RANGE EL 78 TO 82+

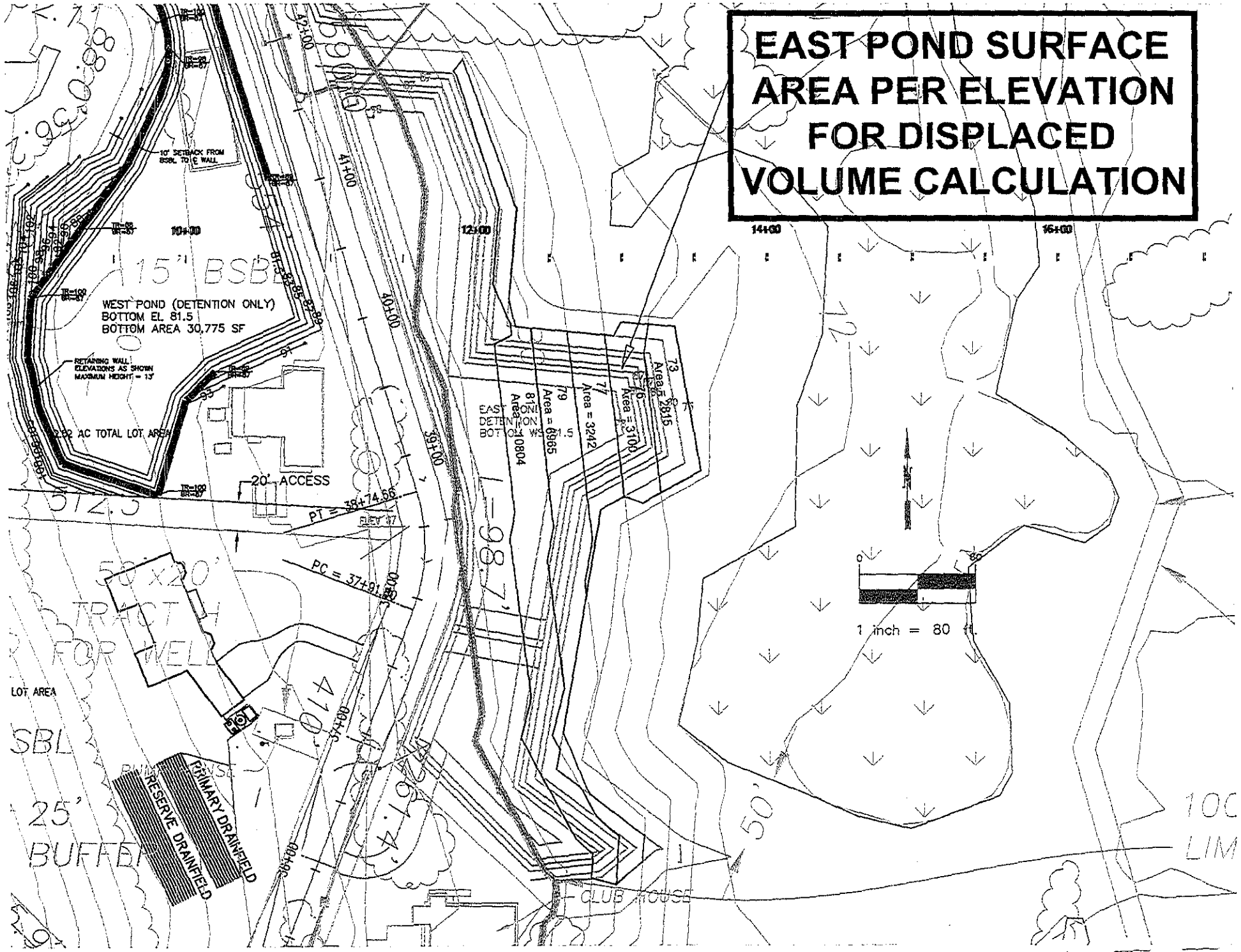
COMPENSATING VOLUME = 24,461 SF X 4.1 = 100,290 CF ✓ OK

EXHIBIT S3

Volume Displaced by East Pond

Assumed 100 yr Flood Elev	Elev Range (ft)	Existing Terrian Average Elev (ft)	Surface Area (sf)	Average Displaced Depth (ft)	Displaced Vol (cf) per Elevation	
82	82-80	81	10804	1	10,804	
82	80-78	79	6965	3	20,895	
82	78-76	77	3242	5	16,210	
82	76-74	75	3100	7	21,700	
82	74-72	73	~~3100~~ 2815	9	~~27,900~~ 25335	
					~~97,500~~ 95000	= Total Displaced Vol (cf)

EXHIBIT S4


EAST POND SURFACE AREA PER ELEVATION FOR DISPLACED VOLUME CALCULATION
WEST POND (DETENTION ONLY)
BOTTOM EL 81.5
BOTTOM AREA 30,775 SF
10' SETBACK FROM BSBL TOE WALL
RETAINING WALL ELEVATIONS AS SHOWN MAXIMUM HEIGHT = 13'
2.62 AC TOTAL LOT AREA
20' ACCESS
PT = 39+74.66
ELEV 87
PC = 37+91.38
50' x 20' TRACT FOR WELL
LOT AREA
PRIMARY DRAINFIELD
RESERVE DRAINFIELD
25' BUFFER
CLUB HOUSE
EAST POND DETENTION BOTTOM WS 81.5
Area = 10804
Area = 8565
Area = 3242
Area = 3100
Area = 5815
1 inch = 80 ft.
I-98
10+00
12+00
14+00
16+00
37+00
39+00
41+00
42+00

CONTINUOUS INFLOW BIOSWALE / WET BIOSWALE

TALL CHIEF ROAD

STA 95+00 TO 62+85

L = 1785'
W = 10' LANE + 3' THICKENED EDGE - PAVED = 1785 X 13 = 23,205 SF = 0.53 Ac
+10' GRASSED SIDE SLOPE = 1785 X 10' = 17,850 SF = 0.41 Ac

W.Q. STORM - 60% of DEV PEAK 2yr FLOW.

LA - 1.0
15 MIN TIME STEPS.

KCATI 2 YR DEV PEAK = 0.25 CFS

WQ = 60% X 0.25 = 0.15 CFS

$$b = \frac{Q n}{1.49\, y^{1.67} S^{1/2}}$$

n = 0.2
y = 4" DEPTH = 0.33'
S = 0.002

$$b = \frac{0.15 \times 0.2}{1.49\,(0.33)^{1.67} \times 0.002^{1/2}} = 6.78' \text{ - USE } 7'$$

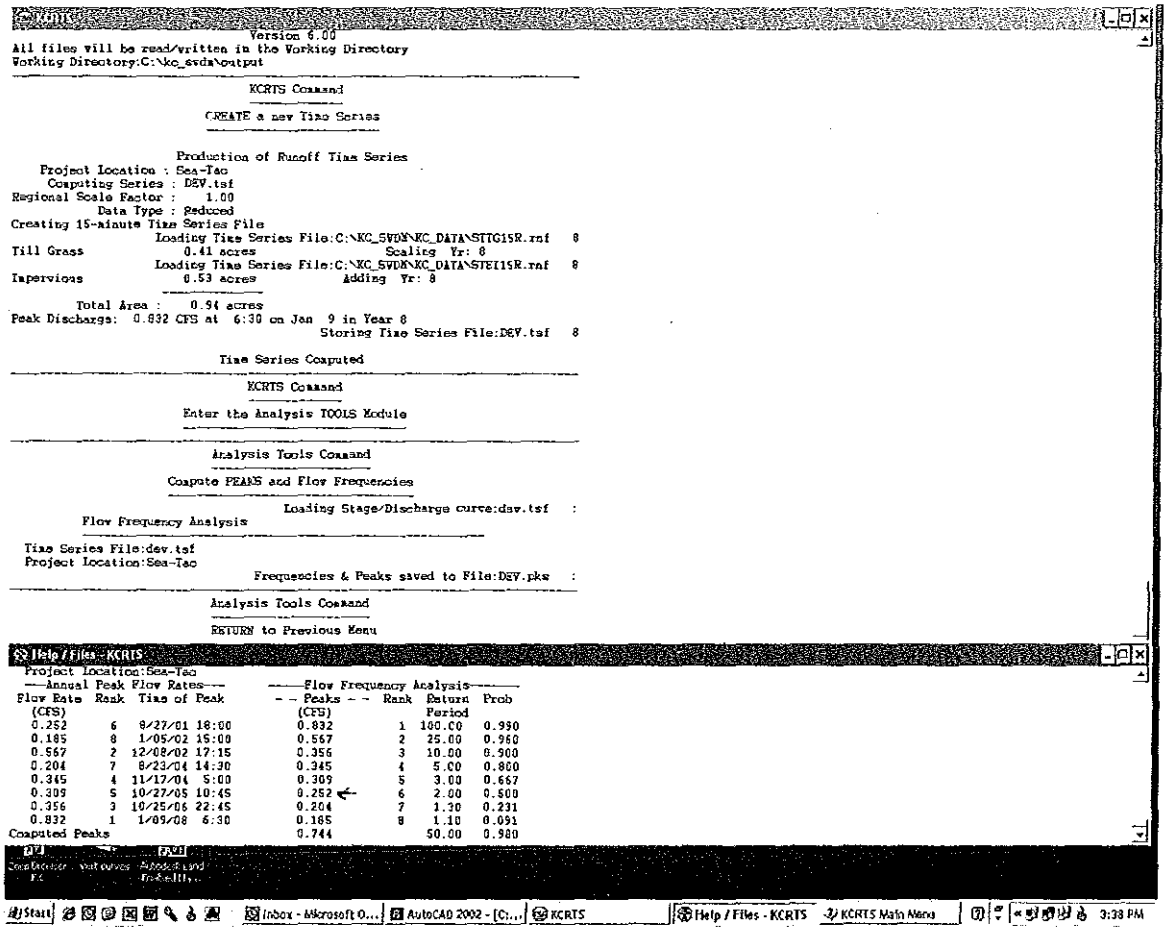
$$V = Q/A = \frac{Q}{by + 2y^2} = \frac{0.15}{7 \times .33 + 3(.33)^2} = 0.6 \text{ fps - OK}$$

$L = 540\, V = 1080 \times 0.06 = 65'$ - NOTE LENGTH ≈ 1400 LF.

NOTE - SHDQ ROAD BIOSWALE AREAS, SLOPES & SIZES ARE SIMILAR

SINCE NEW SHOULDER AREA = 0.44 Ac

TAUCHER ROAD BIOSWALE



```
                                Version 6.00
All files will be read/written in the Working Directory
Working Directory:C:\kc_swdm\output
-------------------------------------------------------------------------------
                              KCRTS Command
                              -------------
                        CREATE a new Time Series
                        ------------------------

                      Production of Runoff Time Series
     Project Location : Sea-Tac
      Computing Series : DEV.tsf
Regional Scale Factor :    1.00
            Data Type : Reduced
Creating 15-minute Time Series File
                    Loading Time Series File:C:\KC_SWDM\KC_DATA\STTG15R.rnf    8
Till Grass              0.41 acres                Scaling  Yr: 8
                    Loading Time Series File:C:\KC_SWDM\KC_DATA\STEI15R.rnf    8
Impervious              0.53 acres                Adding   Yr: 8
                    ------------
         Total Area :    0.94 acres
Peak Discharge:  0.832 CFS at  6:30 on Jan  9 in Year 8
                                        Storing Time Series File:DEV.tsf    8

                          Time Series Computed
-------------------------------------------------------------------------------
                              KCRTS Command
                              -------------
                      Enter the Analysis TOOLS Module
                      -------------------------------
-------------------------------------------------------------------------------
                           Analysis Tools Command
                           ----------------------
                     Compute PEAKS and Flow Frequencies
                     ----------------------------------
                                Loading Stage/Discharge curve:dav.tsf    :
          Flow Frequency Analysis
          -----------------------
 Time Series File:dev.tsf
 Project Location:Sea-Tac
                                Frequencies & Peaks saved to File:DEV.pks    :
-------------------------------------------------------------------------------
                           Analysis Tools Command
                           ----------------------
                           RETURN to Previous Menu
```

Help / Files - KCRTS

```
 Project Location:Sea-Tac
  ---Annual Peak Flow Rates---          -----Flow Frequency Analysis-------
 Flow Rate  Rank  Time of Peak          - - Peaks - -  Rank  Return  Prob
   (CFS)                                   (CFS)          Period
    0.252     6   9/27/01 18:00          0.832          1  100.00  0.990
    0.185     8   1/05/02 15:00          0.567          2   25.00  0.960
    0.567     2  12/08/02 17:15          0.356          3   10.00  0.900
    0.204     7   8/23/04 14:30          0.345          4    5.00  0.800
    0.345     4  11/17/04  5:00          0.309          5    3.00  0.667
    0.309     5  10/27/05 10:45          0.252 <-       6    2.00  0.500
    0.356     3  10/25/06 22:45          0.204          7    1.30  0.231
    0.832     1   1/09/08  6:30          0.185          8    1.10  0.091
Computed Peaks                          0.744              50.00  0.980
```

ENGINEERS NOTES

ROOF DOWNSPOUT - must provide on ALL LOTS < 22000 SF IF FEASIBLE

INFILT SYSTEM - 5.5

- Must have ≥ 3' of permeable soils to groundwater(seasonal)
- IF < 3' of soils, then DISPERSION may be used.
- SIZING per page 5-4
  - SETBACKS - 5' TO STRUCTURE & PL
    - 50' TO STEEP slope OR 15' w/ geotech approval.
  - must be DOWNSTREAM OF SEPTIC

DISPERSION SYSTEM - 5-9

- Must be NO outwash type soils.
- IF < 22,000 SF - USE ON lg. when DOWNSPOUT INFILT IS NOT SUITABLE
- SPLASH BLOCK TO 50' MIN. VEG. FLOWPATH TO PL, STRUCTURE, SAD OR IMPERVIOUS SURFACE
- IF VEG FLOWPATH < 25', THEN USE Perf STUBOUT.

Perf STUBOUT - 5-11

- ONLY when INFILT OR DISP. NOT FEASIBLE.

CREDITS - ⅋ 1-36

- CREDITS DON'T APPLY WHEN DETERMINING ELIGIBILITY FOR CREDITS. EXEMPTIONS.
- When using DWLLSPT INFILT - ROOF may be discounted from imperv. AREA for sizing flow control facility
- When using DWLLSPT DISPERSAL ON LOTS > 25000 SF, ROOF MAY be modeled AS grass surface FOR FLOW CONTROL FACILITY.

[redacted]

ENGINEERS NOTES

FLOW CONTROL

EXEMPTION 5 - FORESTED OPEN SPACE (FOS) 98 KCSWM - pg 1-28, 5-14 to 16.

I - MUST BE RA 2.5, 5, 10 OR 20 ZONE.

II - MUST RESERVE 65% OF THE UNSUBMERGED DISCHARGE AS forested open space in TRACTS OR EASEMENTS. w/ no removal of VEGETATION OR TREES. MAY INCLUDE SAOS. however only UNSUBMERGED portions COUNT. TAX RELIEF AVAILABLE UNDER Public Benefit rating system. FOS may be used for passive recreation & may contain utilities.

III - MUST DISPERSE NEW IMPERV USING FLOW CONTROL BMPS OF Pg 5-15

A. - Roof Downspout Dispersion

B. ROADWAY DISPERSAL

- ONLY ALLOWED ON Rural Neighborhood Collectors & LOCAL ACCESS.
- ~~PAVED~~ USE SHEET FLOW off shoulder to AVOID CONCENTRATION
- IF CONCENTRATED, INCREMENTALLY discharge IN CROSS CULVERTS OR @ end of ~~cut~~ CUT SECTIONS IF $Q_{100} < 0.5$ CFS.
  (IE 10,000 SF IMPERV : $Q = CIA = 0.9 \times 2.5 \times 0.25 \approx 0.5$ cfs)
- ROCK PADS OK for ≤ 0.2 CFS
- DISPERSION TRENCHES - 2x2x50 - 0.5 CFS
  - UP TO 4 TRENCHES ON MAINTAINED
- MUST PASS A 100' VEGETATED FLOW path DOWNHILL for $Q_{100} < 0.2$ CFS

[redacted] ENGINEERS NOTES / SCHEMATIC [redacted]3

SAMPLE

WETPOND CRITERIA - combined wet detention - Pg 6-92
wetponds Pg 6-72

2 cells - 1st cell @ 25 to 35 % of wetpond Vol. (can be 1 cell if < 4000 CF)
Pg 6-72 - baffle berm - 2:1 slope, 5' top to 1' below Wet W.S. (can use ret wall)
" - 7:1 Access to 1st cell bottom
" - 1' sed storage in 1st cell
" - 1st cell min depth = 4' to 8' max
" 2nd cell " 3' " 8' max
" - place inlet/outlet to max. flow path (use baffles if needed).
Pg 6-20 - 5' setback from R to toe slope
" - 3:1 max internal slopes (w/EXCEPTIONS) & 2:1 exterior.
P 6-72 - min 3:1 L to W ratio measured between inlet/outlet & width @ mid depth.
5-21 - Access - must be provided to CMH
" reqd to Pond bottom if bottom AREA > 1500 SF
if bottom < 1500 SF, road can end 4' Above bottom
- internal Berm can function as access. if it is ≤ 4' Above Bottom
(ie 4' max depth w/1' sed storage & berm submerged 1')
- 15% max grade - 12' wide, 15' on curves, 40' outside RAD.
- max berm Height - 6' unless designed by geotech

V. CONVEYANCE SYSTEMS ANALYSIS AND DESIGN

Given the variety of slopes and areas involved in the project, pipe and ditch sizing is beyond the scope of this preliminary report. Final Construction Documents and Final TIR will provide detailed hydraulic analysis.

VI. EROSION/SEDIMENTATION CONTROL DESIGN

Erosion Control Designs (ESC) will be prepared per the County's KCSWM, since the new site impervious area exceeds 5,000 s.f. The plan, together with the grading/drainage plan, will show all existing and proposed topographic features, ESC notes, ESC details and drainage features.

Erosion Control elements will likely consist of Clearing and Grading Limits, Rock Construction Entrance, Silt Fencing and sediment traps and/or ponds.

Preliminary Recommendations for Site Development, Tall Chief Country Club

SUBSURFACE CONDITIONS

The soil conditions underlying the hillsides were explored by the excavation of 13 test pits on November 30 and December 1, 2004. Due to the on-going operation of the golf course, no test pits were excavated in the floodplain. The approximated test pit locations are shown on Figure 1 - Site and Exploration Plan which is included at the end of this report. Details of the exploration program and the test pit logs are presented in Appendix A of this report.

Our test pits were excavated using a trackhoe to depths of 8 to 15 feet below the current ground surface. These test pits indicate that the entire hillsides are underlain by fine-grained soils that include silt and silty clay. These soils almost daylight at the ground surface on the narrow bench where Lots 1 to 9 and 11 to 14 * are proposed as shown on Land Use Study Plan dated 11/22/04. On the other hand, the fine-grain soils are covered by about 5 to 10 feet of coarse-grained soils (sand, silty sand and gravel) in the western and upper portion of the hill where Lots 10 and 15 to 18 are located. In general, the silt and clay are stiff to very stiff in the western and upper portion of the hill and becomes medium stiff to stiff or occasionally soft in the lower eastern portion. This strength reduction appears to be the softening effect resulting from the presence of water-bearing sand lenses and layers in the lower portion of the hillsides.

The coarse-grained soils that cover the silt and clay in the western, upper portion of the hillside are about 2 to 7 feet in thickness. The materials include, silty sand, sand and gravel with varies amount of cobbles. The upper 5 feet of this unit is typically un-cemented and medium dense. We believe a large portion of this unit represents colluviums that were re-deposited by gravity in the past.

The topsoil layer is generally 12 to 24 inches in thicknesses.

GROUNDWATER

Groundwater seepage was only encountered in TP-3 and TP-4. However, water-bearing sand lenses (less than one inch in thickness) and layers (less than one foot in thickness) were encountered in the silt and clay in TP-1, TP-3, TP-4, TP-7 and TP-9. The seepage rates were minor to moderate, about ½ gallon per minute from the test pit side walls. At the time of our test pit excavation, the water-bearing lenses and layers did not produce seepage, however, the moisture in the sand often caused the surrounding silt and clay to soften, especially when disturbed.

We believe that the seepage rate will vary with season and precipitation. However, the moisture condition in the silt and clay may not change much between the dry and wet months as these fine-grained soils have a very low permeability and high internal capillary force. That is, they have a great capacity to draw and keep moisture.

Preliminary Recommendations:

1) Setbacks from top and toe of steep slope (40% or steeper)

* LOTS 1-8 ON 11/22/04 PLAN = LOTS 1-8 ON PRELIM PLAT 12/27/04 AND LOTS 10, 15 THRU 18 ON 11/22/04 PLAN = LOTS 9 THRU 12 ON PRELIM. PLAT 12/27/04.

20 feet no-disturbance buffer
Building setback 15 feet from buffer

2) Drainage control
(To prevent mud flow on steep slope and to protect Lots 11 to 14 and 4 to 9) A surface water drainage swale and a subsurface groundwater interceptor (french)drain along east side of lots 10 and 15 to 18. Frenchdrain depth 8 feet with 8-inch, perforated pipe. Both drains discharge water at bottom of hill and edge of flood plane.

(To protect road) A surface water drainage swale or interceptor drain at the uphill (west) side of new road that is located above flood plane. The bottom of the swale or drain should be at least 3 feet below the roadway subgrade. Water should be discharged at bottom of hill and edge of flood plane.

2) Roadway setback (from edge of pavement to top of slope)
40% slope: 15 feet
30% slope: 10 feet
20% slope: 5 feet

3) Widening of existing access road and construction of new road that are located within 100-year flood plane

Soft and compressible soils are anticipated in the area within 100-year floodplain. Settlement will occur by compression of these soils under increased surface loads. Compression includes primary and secondary consolidations. The latter depends on amount of organic matter in the soil. Elimination of consolidations is possible but economically non-feasible. Best option to reduce consolidations is to surcharge preload the compressible soil. Since consolidation effects (especially the secondary consolidation) can never be completely removed by surcharge preload, a thickened road base is a practical way to mitigate the adverse impact.

The thickened road base should be 24 inches thick granular, select fill plus 6 inches thick crushed rock.

The surcharge pre-load should be at least 5 feet thick of soil fill placed over top of subgrade. Settlement should be monitored (using monitoring plates) in order to determined maturity of primary settlement. Estimated surcharge time (to reach 90% primary consolidation) is 6 to 12 weeks. Secondary settlement will still occur but its magnitude will be reduced by prolonged primary consolidation. Therefore, it is advantage to keep surcharge pre-load in place as long as possible.

4) New road above 100-year floodplain

The subsoils in the area consist of fine-grained silt and clay with lenses and layers of water-bearing sand. The materials are very susceptible to strength loss due to disturbance and increase moisture. Construction in wet months should be avoided. A thickened road base of 12 inches thick granular, select fill plus 6 inches thick crushed rock is recommended.

REPORT OF GEOTECHNICAL INVESTIGATION
TALL CHIEF COUNTRY CLUB
KING COUNTY, WASHINGTON
S&EE JOB NO. 434
DECEMBER 14, 2004

S&EE
SOIL & ENVIRONMENTAL ENGINEERS, INC.
16625 Redmond Way, Suite M 124, Redmond, Washington 98052, (425) 868-5868 FAX (425) 868-7427

December 14, 2004

Mr. James Zogg
C/O Lang Associates
10658 Riviera Place NE
Seattle, WA 98125
Attn: Mr. De-En Lang

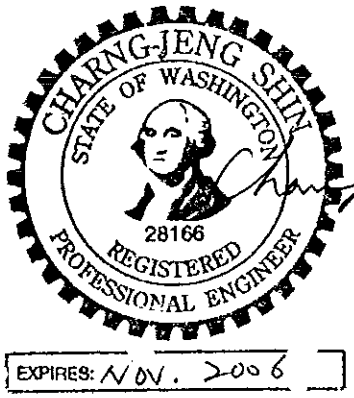
Report
Geotechnical Investigation
Tall Chief Country Club
King County, Washington

Dear De-En:

We are pleased to present herewith our Report of Geotechnical Investigation for the referenced project. Our services were authorized by Mr. James Zogg on November 22, 2004, and have been provided in accordance with our proposal dated November 19, 2004.

We appreciate the opportunity to provide our services. Should you have any question regarding the contents of this report or require additional information, please call.

Very truly yours,
SOIL & ENVIRONMENTAL ENGINEERS, INC.



12-14-04

C. J. Shin, Ph.D., P.E.
President

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REPORT OF GEOTECHNICAL INVESTIGATION
TALL CHIEF COUNTRY CLUB
KING COUNTY, WASHINGTON

for

Tall Chief Golf, Inc.

1.0 INTRODUCTION

We present in this report the results of our geotechnical investigation for the proposed development. The site is roughly 191 acres in size and currently occupied by Tall Chief Golf course in King County, Washington. We understand that the proposed development will involve 18 single-family lots. The exiting access road from the West Snoqualmie River Road to the northern portion of the golf course will be widened and a new road is proposed from the west end of this access road to the south end of the residential development (see Figure 1). The grading plan is not available at the time of this report. However, we anticipate that the maximum cut and fill will be on the order of 10 feet. For the purpose of this study, we have assumed that the structural load of future houses will be typical of residential homes. All references to road alignments and lot numbers are based on "Land Use Study Plan-Tall Chief County Club" prepared by Lang Associates, Inc. dated November 22, 2004.

2.0 SCOPE OF SERVICES

The purpose of our geotechnical investigation is to develop recommendations regarding site preparation and foundation support. Specifically, our services included:

1. Review of available geologic information for the site and its vicinity.

2. Site reconnaissance to observe surface conditions including obvious signs of slope instability and wet and unstable soils.

3. Exploration of soil and groundwater conditions underlying the site through the excavation of 13 test pits.

4. Recommendations regarding type of foundation support. Our recommendations include allowable soil-bearing pressure and the total and differential settlements.

5. Recommendations regarding potential impacts of groundwater on site development.

6. Recommendations regarding the roadway construction.

7. Evaluation of the stability of the onsite slopes, recommendation regarding setback and mitigations.

8. Recommendations regarding active and at-rest earth pressures to be used for the design of any retaining structures.

9. Recommendations regarding site preparation, including removal of unsuitable soils, suitability of onsite soils for use as fill, fill placement techniques, and compaction criteria.

10. Five copies of a written geotechnical report containing a site plan, test pit logs, a description of subsurface conditions, and our findings and recommendations.

3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

The property is located at the west bank of Snoqualmie River about 2 miles northwest of Fall City, Washington. Topographically, the site includes a flat, low-lying area in the northeastern portion and east-facing hillsides in the western and southern portions. The low-lying area is located within a 100-year flood plain. From this area westward, the grade rises to a long and narrow bench that flanks the foothill. The slope on this bench varies from about 10 to 25 percent. Most of the new residential lots will be constructed on this bench and a new road is proposed along the east side of this bench. The rise from the flood plain to this bench is relatively gentle in the northern 1/3 of the site, whereas the rise is relatively steep (about 30 to 40 percent) in the southern 2/3 of the site. From the west side of the bench, the grade ascends steeply westward for about 80 to 120 vertical feet with 40 percent or steeper slopes. The grade becomes a gentle slope from the top of this steep slope to the west property line. The slopes here rises about 80 to 150 vertical feet with 15 to 30 percent slopes. Five new lots (10 and 15 to 18) are proposed on this gentle slope.

At the time of this report, all slopes are covered with dense trees and thick undergrowth. During our site reconnaissance, we observed some localized slumps in the areas of steep slopes. These slumps appeared to be the result of previous sloughing that occurred within the upper 5 to 10 feet of the slope surfaces. We did not observe any obvious signs of deep-seated slope instability which typically include tilting trees, hummocky terrains, and cracks and fissures at the ground surface.

3.2 SOIL SURVEY

Published soil survey (*King County Area, Washington by United States Department of Agriculture, Soil Conservation Service, 1973*) indicates that the low lying area of the site is covered by Nooksack silt loam (Nk), and the hill area is covered by Alderwood and Kitsap soils. The latter has a severe to very severe erosion hazard.

3.3 GEOLOGY

Published geologic information (*Surficial Geologic Map of The Skykomish and Snoqualmie Rivers Area, Snohomish and King Counties, Washington, by Derek B. Booth, 1990*) indicates that the low lying area and the hill are underlain by alluvial and glacial deposits, respectively. The latter include Advance Outwash in the area of lower elevations (below 300 feet) and Vashon till in the area of higher elevations (above 300 feet). The outwash is typically a dense sand and gravel, and the till is typically a hard, unsorted mixture of clay, silt, sand and gravel.

3.4 SUBSURFACE CONDITIONS

Due to the on-going operation of the golf course, no test pits were excavated in the flood plain. However, based on the geologic information and our experience with the flood plain deposits we anticipate that compressible soils are present in the area. The soil conditions underlying the hillsides were explored by the excavation of 13 test pits on November 30 and December 1, 2004. The approximated test pit locations are shown on Figure 1 - Site and Exploration Plan which is included at the end of this report. Details of the exploration program and the test pit logs are presented in Appendix A of this report.

Our test pits were excavated using a trackhoe to depths of 8 to 15 feet below the current ground surface. These test pits indicate that the hillsides are underlain by fine-grained soils that include silt and silty clay. These soils almost daylight at the ground surface on the narrow bench where Lots 1 to 9 and 11 to 14 are proposed as shown on Land Use Study Plan dated 11/22/04. On the other hand, these fine-grain soils are covered by about 5 to 10 feet of coarse-grained soils (sand, silty sand and gravel) in the western and upper portion of the hill where Lots 10 and 15 to 18 are located. In general, the silt and clay are stiff to very stiff in the western and upper portion of the hill and becomes medium stiff to stiff or occasionally soft in the lower eastern portion. Our test pits found that the silt and clay in the lower eastern portion of the site contains water-bearing sand lenses (less than one inch in thickness) and layers (less than one foot in thickness). The strength reduction of the silt and clay appears to be the softening effect resulting from the moisture in the water-bearing sand.

The coarse-grained soils that cover the silt and clay in the western, upper portion of the hillside are about 2 to 7 feet in thickness. The exception to this is at TP-6 and TP-8 where the coarse-grained soils are at least 11 and 9 feet in thickness, respectively. The materials include, silty sand, sand and gravel with varies amount of cobbles. The upper 5 feet of this unit is typically un-cemented and medium dense. We believe that a large portion of this unit represents colluviums that were re-deposited by gravity in the past.

The topsoil layer is generally 12 to 24 inches in thicknesses.

3.5 GROUNDWATER

Groundwater seepage was encountered in TP-3 and TP-4. The seepage rates were minor to moderate, about ½ gallon per minute from the test pit side walls. Water-bearing sand lenses and layers were encountered in the silt and clay in TP-1, TP-3, TP-4, TP-7 and TP-9. At the time of our test pit excavation, these water-bearing lenses and layers did not produce any seepage, however, the moisture in the sand often caused the surrounding silt and clay to soften, especially when disturbed.

We believe that the seepage rate will vary with season and precipitation. However, the moisture condition in the silt and clay may not change much between the dry and wet months as these fine-grained soils have a very low permeability and high internal capillary force. That is, they have a great capacity to draw moisture and keep it between particles.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 GENERAL

1. The development of the subject site is feasible from a geotechnical standpoint. The hillsides are currently stable except for a minor potential of shallow sloughing on and adjacent to the steep slopes. Provided that the recommendations in this report are followed, we believe that the potential of future slope instability will be very low. Please be aware that there is always an inherent risk of slope movement for any development near or on slopes. In addition to natural factors (soil, groundwater, heavy rainfall), other factors that may affect stability include excavations, fills, leaking or broken utility, improper drainage, lack of maintenance of drainage facilities or vegetation cover, unwise actions by adjacent property owners, or similar events or unknown conditions that may cause instability. Therefore, future property owners must be alert of any adverse impacts on the slope stability and take appropriate actions when necessary.

2. The expansion of the existing access road and a portion of the new road will be constructed in the flood plain. Although no test pit was excavated in the area, it is anticipate that compressible soils are present and the consolidation of these soils may cause premature pavement failure, if not mitigated. Our recommendations include a thickened road base and surcharge preload.

3. The new road above the flood plain will be constructed over potentially unstable soils. These soils consist of silt and clay with lenses and layers of water-bearing sand. The materials are very susceptible to strength loss due to disturbance and increase moisture. Our recommendations include a thickened road base and roadside drainage.

Details of our recommendations are presented in the following sections.

4.2 DRAINAGE CONTROL, BUFFER AND SETBACKS

BUFFER AND SETBACK

Buildings: We recommend a no-disturbance (buffer) zone of 25 feet from the top and toe of steep slope (over 40%), and a building setback of 15 feet from the buffer. No grading and clearing shall be allowed in the buffer. The existing vegetation in the buffer and on the steep slope should be protected.

Roads: A large portion of the new road will be constructed along the eastern edge of the foothill. The subsoils here are predominately fine-grained soils with lenses and layers of water-bearing sand. These soils and the slopes in the area can become unstable when wet or disturbed. We thus recommend the following setbacks from edge of pavement to the top of slopes:

40% slope: 15 feet
30% slope: 10 feet
20% slope: 5 feet

Recommendations for roadway construction including thickened road base and drainage along the road are presented in **Section 4.9 ROADWAY CONSTRUCTION** of this report.

DRAINAGE CONTROL

In general, the site development will decrease infiltration and increase surface runoff. Such change of flow patterns may cause concentrated flow at the edges of steep slopes. Since the hillsides are mantled by granular soils over relatively impermeable silt and clay, the increased groundwater flow must be handled to avoid adverse impacts on slope stability. A surface water drainage swale and a subsurface groundwater interceptor drain (frenchdrain) are commonly used for hillside development. We believe that they would work well for the drainage control for the current project. The swale and frenchdrain should be constructed outside of the above-mentioned buffer, along the east side of Lot 10 and 15 to 18. The swale should be located upslope from the frenchdrain with a horizontal space of at least 5 feet between the two systems. The frenchdrain should be at least 8 feet in depth. Most of the trench subgrade will be excavated into the fine-grained soils. Permeable granular soils may be encountered at isolated locations along the trench. When this occurs, the bottom 12 inches of the trench should be lined

with a 20-mil PVC liner.

A perforated drain pipe of at least 8 inches in diameter should be installed at the bottom of the frenchdrain and the trench should be backfill with open-coarse crushed rock such as 2-inch ballast rock. The water in the swale and the frenchdrain should not be combined until they are connected to the discharge pipe. The ideal outfall location is the base of the hill (edge of flood plain). The design of the drainage system including the outfall location should be approved by S&EE, Inc. and the construction of the swale and frenchdrain should be monitored by an engineer from our office.

Except for the septic system, infiltration should be avoided and water should not be allowed to flow over steep slopes. We understand that stormwater infiltration may be considered for the new development to the west of the site. Since this development is upslope from the current project, any infiltration may incur adverse impact on the current project and should be evaluated in the future. If necessary, a line of groundwater interceptor drain may be considered near the western site boundary.

4.3 MITIGATION OF EROSION HAZARDS

Other than the flood plain the entire site area is susceptible to erosion. We recommend that an Erosion Control and Sediment Management Plan be installed for the construction period. This plan should include methods of interception, collection and discharging of stormwater so that runoff would not sheet flow over denuded areas and cause erosion. The erosion and sediment control methods presented in King County Surface Water Design Manual should be considered.

We further recommend that a wet-season erosion control plan be prepared prior to October 1. Depending on the site conditions at the time, the plan should include, as a minimum, the covering method for all denuded areas. The local authorities may request a Temporary Erosion and Sediment Control (TESC) monitoring program throughout the wet season (from October 1 to April 30). We recommend that this wet-season erosion control plan be prepared and the TESC monitoring be performed by a qualified geotechnical engineer, if needed.

4.4 FOUNDATION SUPPORT

We recommend that all structures be supported by conventional spread footings. The footings must be founded on structural fill or at least medium dense native soils. Please note that our test pits were loosely filled with the excavated soils. If these test pits coincide with the future footing locations, the upper 4 feet of the fill in the test pits should be removed, and then the pit backfilled with structural fill. The criteria for structural fill are presented in **Section 4.10 SITE PREPARATION AND STRUCTURAL FILL.** Details of our recommendations regarding the footing design are presented below.

Bearing Capacity: We recommend an allowable bearing pressure of 3,000 pounds per square feet (psf) for the footing design. This value includes a safety factor of at least 3, and can be increased by one-third for wind and seismic loads.

Footing Construction: The footing bearing materials will be moisture sensitive and susceptible to strength loss due to wetting and disturbance. As such, the footing bearing surfaces should be protected from weather and disturbance, and all organic, softened and loosened soils must be removed by over-excavation. Any over-excavation at the footing subgrade should be backfilled with structural fill, concrete, lean concrete or crushed rock. The crushed rock, if used, should be placed in 6 inches thick lifts and compacted by at least three passes of a compactor weighing greater than 200 pounds.

All footing subgrade should be inspected by a qualified geotechnical engineer prior to re-bar and concrete placements.

All exterior footings should be founded at least 18 inches below the adjacent finished grade to provide protection against frost action, and should be at least 18 inches in width to facilitate construction.

Settlement: Interior column footings designed in accordance with the above recommendations are expected to experience approximately 1/2 inch of settlement. Continuous wall footings should experience about 1/4 to 1/2 inch. Differential settlement between adjacent footings is expected to be 1/4 to 1/2 of an inch.

Lateral Resistance: Lateral resistance can be obtained from the passive earth pressure against the footing sides and the friction at the contact of the footing bottom and bearing soil. The former can be obtained using an equivalent fluid density of 250 pounds per cubic foot (pcf), and the latter using a coefficient of friction of 0.5. These values include a safety factor of 1.5.

Footing Near Slopes: For any footings near slopes of 20 percent or steeper, the bottom of the footing must be positioned in such a way that the horizontal distance from the outside footing edge to the slope face is at least 12 feet.

Footing Drain: Rigid, perforated drainpipes should be installed around all perimeter footings. Drainpipes should be at least 4 inches in diameter, covered by a layer of uniform size drain gravel of at least 12 inches in thickness, and be connected to a suitable discharge location. An adequate number of cleanouts should be installed along the drain line for future maintenance. **Footing drains should be separated from roof drains.**

4.5 SLAB SUPPORT

All slabs-on-grade can be supported on structural fill or at least medium dense native soils. We envision that the soil at the slab subgrade will be disturbed and loosened by construction activities at the time of slab construction. We therefore recommend that the slab subgrade be proof-rolled or probed just before pour. Any wet and loose areas should be over-excavated and backfilled with structural fill.

In order to promote uniform support and provide a capillary break, we recommend that slabs be underlain by a 6 mil. vapor barrier over a 4-inch thick layer of free draining gravel.

4.6 LATERAL EARTH PRESSURES

Lateral earth pressures on retaining walls or permanent subsurface walls, and resistance to lateral loads may be estimated using the following recommended soil parameters:

Soil Density (PCF)	Equivalent Fluid Unit Weight (PCF)			Coefficient of Friction
	Active	At-rest	Passive	
130	30	45	250	0.5

Note: 1) Hydrostatic pressures are not included in the above lateral earth pressures.

2) Lateral earth pressures are appropriate for level structural fill placed behind and in front of walls.

The active case applies to walls that are permitted to rotate or translate away from the retained soil by approximately 0.002H, where H is the height of the wall. This would be appropriate for a cantilever retaining wall. The at-rest case applies to unyielding walls, and would be appropriate for walls that are structurally restrained from lateral deflection such as basement walls, utility trenches or pits.

Additional lateral earth pressures will result from surcharge loads from floor slabs or pavements for parking that are located immediately adjacent to the walls. The surcharge-induced lateral earth pressures are uniform over the depth of the wall. Surcharge-induced lateral pressures for the "active" case may be calculated by multiplying the applied vertical pressure (in psf) by the active earth pressure coefficient (Ka). The value of Ka may be taken as 0.3. The surcharge-induced lateral pressures for the "at-rest" case are similarly calculated using an at-rest earth pressure coefficient (Ko) of 0.5.

Appropriate earth pressures must be provided by S&EE, Inc. for sloping backfill behind and in front of retaining walls.

DRAINAGE AND BACKFILL OF RETAINING WALLS

Retaining walls should be backfilled with free-draining materials which are typically granular soils containing less than 5 percent fines (silt and clay particles) and no particles greater than 4 inches in

diameter.

The backfill material should be placed in 6 to 8-inch thick horizontal lifts and compacted to at least 90 percent of the maximum density in accordance with ASTM D-1557 test procedures. In the areas where the fill will support pavement, sidewalk or slabs, the top two feet of the backfill should be compacted to at least 95 percent of the maximum density. Care must be taken when compacting backfill adjacent to retaining walls, to avoid creating excessive pressure on the wall.

Rigid, perforated drainpipes should be installed behind retaining walls. Drainpipes should be at least 4 inches in diameter, covered by a layer of uniform size drain gravel of at least 12 inches in thickness, and be connected to a suitable discharge location. An adequate number of cleanouts should be installed along the drain line for future maintenance.

4.7 ROCKERY WALLS

In addition to concrete retaining walls, reinforced or non-reinforced rockery walls can be considered for grading purposes. Please note that rockery walls should be designed by a geotechnical engineer for the following conditions:

1. The wall will be used to retain fill.
2. The surface behind the wall is not level.
3. The wall will retain a cut embankment greater than 6 feet in height.

The design should consider the slope behind the wall, the wall height, the surcharge load behind the wall, and the strength of the reinforcing material (if required). We will be glad to perform this design, if requested.

4.8 TEMPORARY AND PERMANENT EXCAVATIONS

When temporary excavations are required during construction, the contractor should be responsible for the safety of their personnel and equipment. The followings cut angles are provided only as a general reference:

For temporary excavations less than 4 feet in depth, the cut bank may be excavated vertically. For temporary excavations greater than 4 feet in depth, the cut can be 1H:1V. Flatter slopes for all temporary cuts may be required if seepage occurs.

All permanent slopes should be no steeper than 3H:1V. Water should not be allow to flow uncontrolled over the top of any slope. Also, all permanent slopes should be seeded with the appropriate species of vegetation to reduce erosion and maintain the slope stability.

4.9 ROADWAY CONSTRUCTION

4.9.1 Road within Flood Plain

This portion of the road includes the widening of the existing access road and the construction of the new road in the northern part of the development. Soft and compressible soils are anticipated in the flood plain. Settlement will occur by compression of these soils under increased surface loads. The compression includes primary and secondary consolidations. The latter depends on amount of organic matter in the soil. Elimination of consolidations is possible but economically non-feasible. We believe that the best mitigation action is to apply a surcharge preload in the area of the road. Since consolidation effects (especially the secondary consolidation) can never be completely removed by a surcharge preload, a thickened road base is a practical way to further mitigate the adverse impact.

The thickened road base should consist of 2 feet thick, granular select fill placed over the prepared subgrade. The top edges of this base should be at least 2 feet beyond the edges of the pavement. The pre-load should consist of 5 feet thick of surcharge fill placed over the base. The edges of the surcharge fill should be no steeper than 1H:1V and the top of the slope should also be at least 2 feet beyond the edges of the pavement. The criteria for subgrade preparation, select fill and surcharge fill can be found in Section **4.10 SITE PREPARATION AND STRUCTURAL FILL.**

The settlement should be monitored in order to determine the maturity of primary consolidation. A sketch showing the settlement marker is included in Figure 2. We recommend that one settlement marker be installed for every 200 feet of the road. Care should be taken to protect these markers from disturbance by construction equipment. The markers should be surveyed initially prior to the placement of any fill, then weekly after the completion of the fill placement. Settlement readings should be transmitted to and evaluated by S&EE, Inc. We anticipate that a primary settlement of about 4 to 6

inches will occur under the pre-load in 8 to 12 weeks. Upon completion of the primary settlement the surcharge fill may be removed. Please note that the secondary settlement will still occur but its magnitude will be reduced by prolonged primary consolidation. Therefore, it is advantage to keep the pre-load in place as long as possible.

4.9.2 New Road outside Flood Plain

As previously mentioned, the southern portion of the new road will be constructed along the top of slopes. The soils in the area consist of silty and clayey, fine-grained soils with lenses and layers of water-bearing sand. These materials are very susceptible to strength loss due to disturbance and increase moisture. Therefore, construction in wet months should be avoided and setbacks from the top of slopes are recommended. **(See Section 4.2 for details)**.

In addition, a thickened road base consisted of 12 inches thick structural fill is recommended. The criteria of structural fill are presented in the next section. A surface water drainage swale should be installed along the uphill (west) side of the road. The bottom of this swale should be at least 3 feet below the roadway subgrade. Water should be discharged to the bottom of the hill (edge of flood plain).

4.9.3 New Road across Ravine

The new road will across an existing ravine at the east side of Lot 7. We envision that the road base can be built with new structural fill placed in the ravine. The criteria of structural fill are presented in the next section. Care must be taken in preparing the subgrade. In general, all vegetation and topsoil should be removed and the slope faces should be benched as every few lifts of the fill are placed. Subsurface drains may be needed in strategic locations to avoid buildup of hydrostatic pressure in or behind the fill embankment. The subgrade preparation, fill operation and installation subsurface drains should be monitored by an engineer from our office.

4.10 SITE PREPARATION AND STRUCTURAL FILL

We recommend that areas of structures and roads be stripped of vegetation, tree roots, and topsoil. All

underground utilities should also be removed. After stripping and excavation, subgrades of slabs, pavement, or areas to receive new fill should be thoroughly proof-rolled using heavy construction equipment. If the subgrade is wet and proof rolling is not feasible, the area should be probed using a steel bar so as to avoid disturbance and rutting of the subgrade soils. Areas which are found to be loose or soft, or which contain organic soils should be over-excavated. Geotextile can be considered in areas where over-excavation is not suitable.

The proof-rolling and/or probing should be observed/performed by an engineer from our office. Our engineer will evaluate the over-excavation requirements and provide recommendation regarding the use of geotextile, if needed.

After stripping, over-excavation and excavation to the design grade, the top 12 inches of the native soils should be re-compacted to at least 90% of their maximum dry density as determined using ASTM D-1557 test procedures (Modified Proctor test).

Structural fill can then be placed in the over-excavation and fill areas. All fill materials should be approved by S&EE, Inc. prior to use and should meet both the material and compaction requirements presented below.

MATERIAL REQUIREMENTS

Structural Fill: The material should be free of organic and frozen material. The on-site silty sand, sand and gravel are suitable for use as structural fill. These soils are available in the western, higher elevations of the site. The silty sands are moisture sensitive and should be moisture-conditioned to within ± 2% of their optimum moisture content prior to use. Suitable imported structural fill materials include sand, gravel, sand and gravel (pitrun), and crushed rock.. The onsite silt and clay are not suitable for use as structural fill.

Granular Select Fill: The material should be used for the thickened road base that is to be constructed in the flood plain. Only coarse-grained soils such as pitrun, gravel and crushed rock should be used. In general, the material should have a fines (particles size smaller than a no. 200 sieve) content less than 5 percent. Some of the granular soils in the western, upper portion of the site may be suitable. However, the use of onsite soils for select fill must be approved by S&EE, Inc.

Surcharge Fill: The surcharge fill should have an in-place total density of at least 120 pounds per cubic feet. All onsite soils are suitable for use as surcharge fill.

PLACEMENT AND COMPACTION REQUIREMENTS

Structural Fill and Granular Select Fill: The materials should be placed in loose horizontal lifts not exceeding a thickness of 12 inches. Structural fill should be compacted to at least 95% of the maximum dry density as determined using the ASTM D-1557 test procedures. Care must be taken when structural fill is placed on slopes. The procedure requires that the existing slope be benched so that the new fill can be keyed into the slope. We recommend testing the fill as it is placed.

Surcharge Fill: Depending on the material type and equipment used, the surcharge fill should be placed in 12 to 18 inches thick lifts and compacted to least 90% of the maximum dry density as determined using the ASTM D-1557 test procedures.

Excavation subgrade and site surface should be graded so that surface water is directed away from the structural areas. Standing water should not be allowed. Final grades should be sloped away from buildings and roads unless the area is paved.

4.11 SEISMIC CONSIDERATIONS

We recommend that Site Class D as defined in the 2003 IBC be considered for the building design. Liquefaction is a condition when strong vibration or shaking of the ground results in the excess pore pressures in saturated soils and subsequent loss of strength. Liquefaction can result in ground settlement or heaving. In general, soils which are susceptible to liquefaction include saturated, loose to medium dense sands (i.e., below the water table). The liquefaction potential is negligible for areas above flood plain, and high for areas within flood plain. The impact on the roadway will be uneven settlement and thus pavement failure.

Some repair work should be anticipated after strong seismic events, and to provide a design without the need for any repair would be uneconomical. It is our opinion that the thickened road base will provide some capacity to reduce uneven settlement and no additional liquefaction mitigation measures are necessary.

4.12 FLEXIBLE PAVEMENT

We recommend that the subgrade for flexible pavement be prepared in accordance with the recommendations presented in **Section 4.10 SITE PREPARATION AND STRUCTURAL FILL.** Based on the subsoil conditions, we believe that the prepared subgrade will have a California Bearing Ratio (CBR) of at least 10.

We recommend the following flexible pavement sections for light and medium traffic conditions:

Light traffic (Daily EAL = 5 or less): 2 inches asphaltic concrete over 4 inches base course
Medium traffic (Daily EAL = 20 to 80): 3 inches asphaltic concrete over 6 inches base course

The base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557 test method. The material should meet WSDOT aggregate specification 9-03.9(3) and have the following gradation:

Sieve Size	Percent Passing
1 ¼-inch	100
5/8-inch	50-80
1/4-inch	30-50
US No. 40	3-18
US No. 200	7.5 max.
% Fracture	75 min.

4.13 ADDITIONAL SERVICES

Additional services may be required during the design and construction of the project. We envision that these additional services may include the following:

1. Review of design plans and response to contractor's questions and county's comments.

2. Provision of rockery wall and other geotechnical designs.

3. Monitoring of site grading and roadway subgrade preparation.

4. Monitoring the installation of surcharge pre-load; evaluation of settlement data and the maturity of primary settlement.

5. Monitoring the installation of surface and subsurface drains; observation and approval of discharge locations.

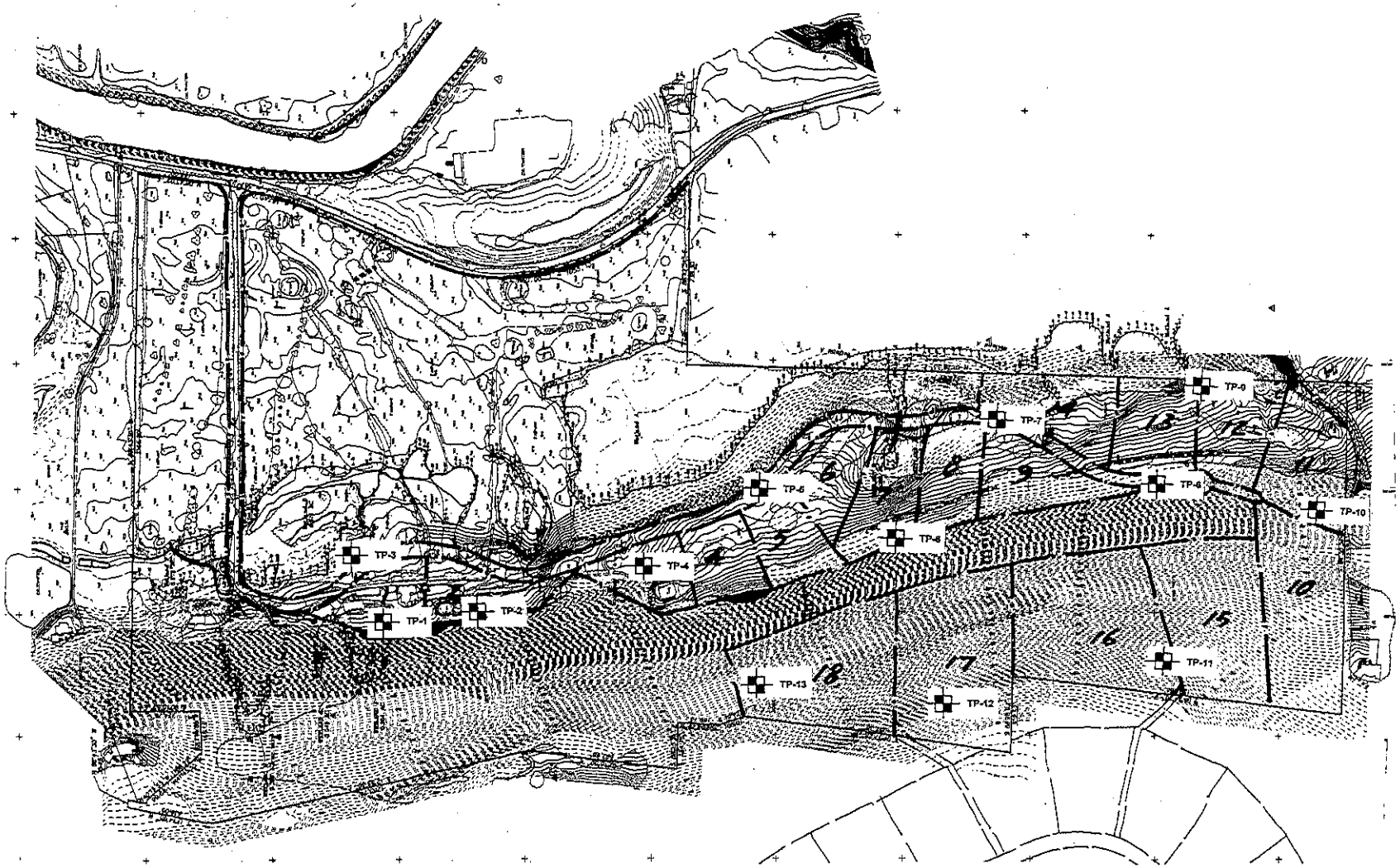
6. Monitoring of foundation subgrade preparation. Our representative will confirm the bearing capacity of the subgrade soils, and will assist the contractor in evaluating the over-excavation requirements, if any.

7. Monitoring the placement and compaction of structural and select fill. Our representative will confirm the suitability of the fill materials, perform field density tests, and assist the contractor in meeting the compaction requirements.

8. Other geotechnical issues deemed necessary.

5.0 CLOSURE

The recommendations presented in this report are provided for design purposes and are based on soil conditions disclosed by field observations and subsurface explorations. Subsurface information presented herein does not constitute a direct or implied warranty that the soil conditions between exploration locations can be directly interpolated or extrapolated or that subsurface conditions and soil variations different from those disclosed by the explorations will not be revealed. The recommendations outlined in this report are based on the assumption that the development plan is consistent with the description provided in this report. If the development plan is changed or subsurface conditions different from those disclosed by the exploration are observed during construction, we should be advised at once so that we can review these conditions, and if necessary, reconsider our design recommendations.



S&EE
Job no. 434

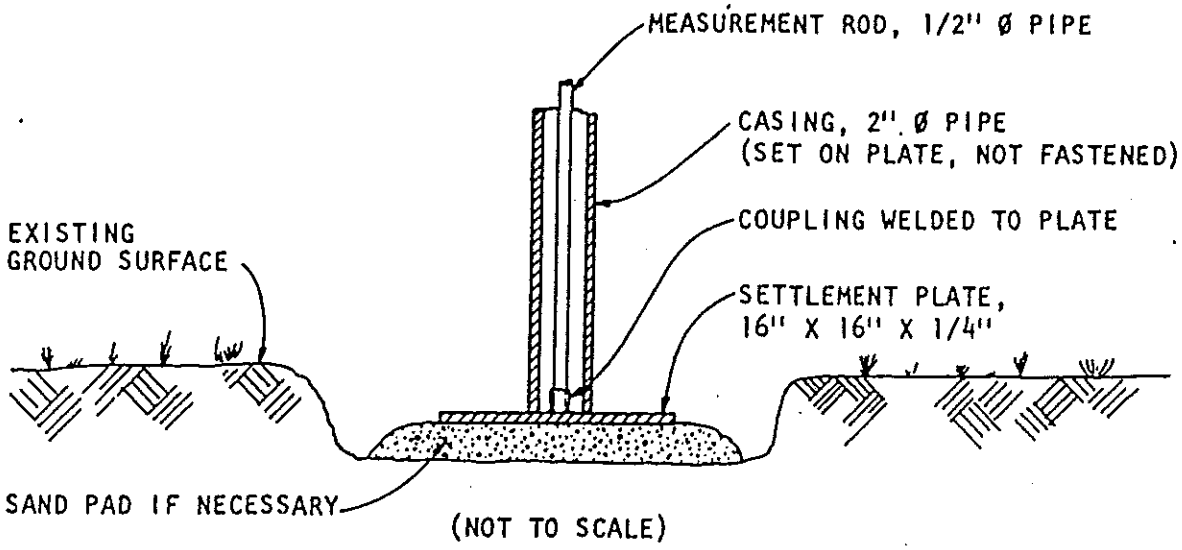
TP-1 Test pit number and location

0 400 800
Scale in Feet

N

Reference: "Topographic/Aerial Map", dated October 12, 2004 and prepared by Harmsen & Associates, Inc.

Figure 1
Site and Exploration Plan
Tall Chief Country Club
King County, Washington



NOTES:

1. INSTALL MARKERS ON FIRM GROUND OR ON SAND PADS IF NEEDED FOR STABILITY. TAKE INITIAL READING ON TOP OF ROD AND AT ADJACENT GROUND LEVEL PRIOR TO PLACEMENT OF ANY FILL.

2. FOR EASE IN HANDLING, ROD AND CASING ARE USUALLY INSTALLED IN 5-FOOT SECTIONS. AS FILL PROGRESSES, COUPLINGS ARE USED TO INSTALL ADDITIONAL LENGTHS. CONTINUITY IS MAINTAINED BY READING THE TOP OF THE MEASUREMENT ROD, THEN IMMEDIATELY ADDING THE NEW SECTION AND READING THE TOP OF THE ADDED ROD. BOTH READINGS ARE RECORDED.

3. RECORD THE ELEVATION OF THE TOP OF THE MEASUREMENT ROD IN EACH MARKER AT THE RECOMMENDED TIME INTERVALS. EACH TIME, NOTE THE ELEVATION OF THE ADJACENT FILL SURFACE.

4. READ THE MARKER TO THE NEAREST 0.01 FOOT, OR 0.005 FOOT IF POSSIBLE. NOTE THE FILL ELEVATION TO THE NEAREST 0.1 FOOT.

Figure 2
Settlement Marker

APPENDIX A

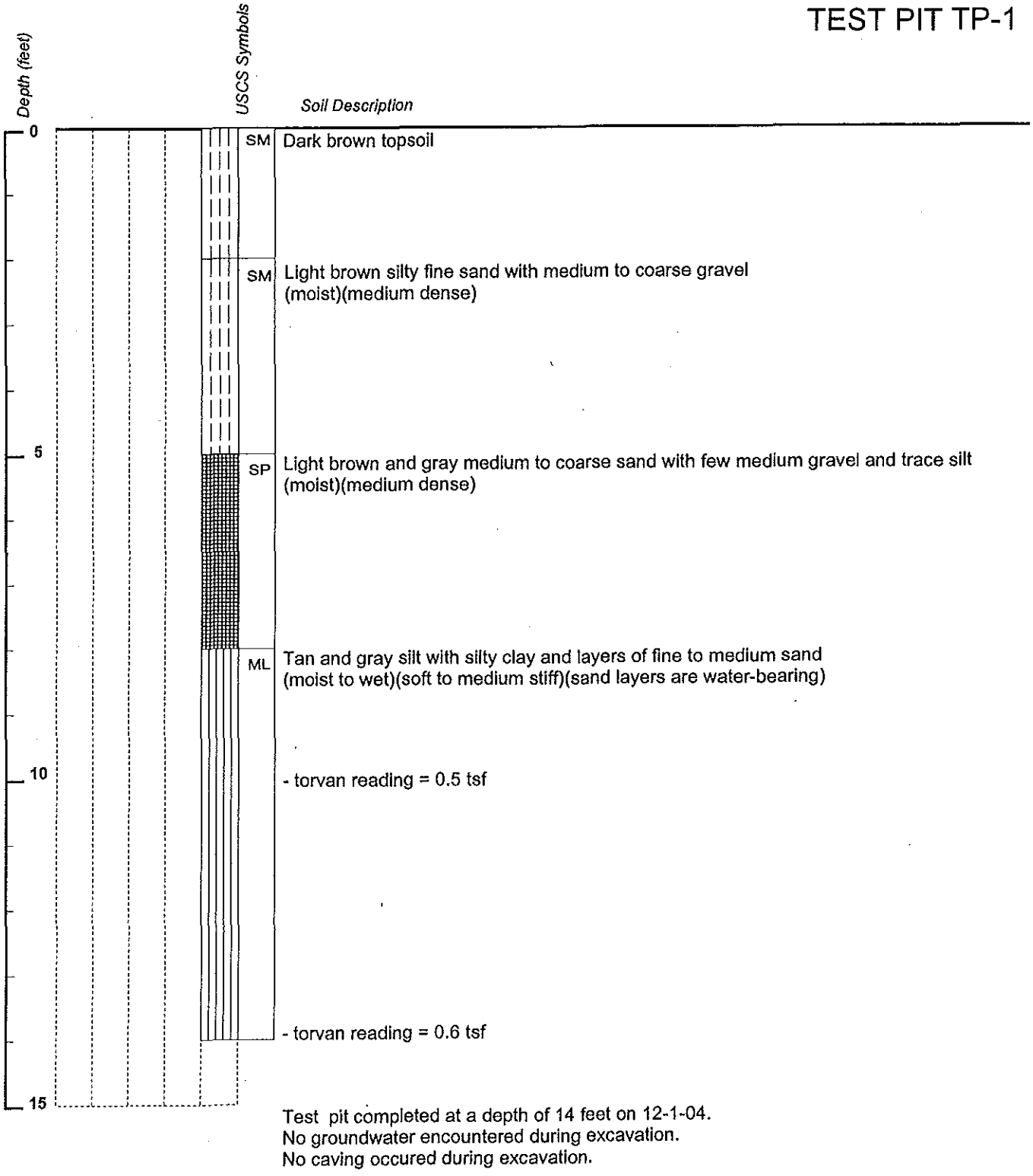
FIELD EXPLORATION AND LOGS

Due to the on-going operation of the golf course, no test pits were excavated in the flood plain. The soil conditions underlying the hillsides were explored by the excavation of 13 test pits on November 30 and December 1, 2004. The approximated test pit locations are shown on Figure 1 - Site and Exploration Plan which is included at the end of this report.

The test pits were excavated with an Hitachi 120-5 EX trackhoe. A representative from S&EE was present throughout the exploration to excavate the pits and log the subsurface soil conditions. Test pit logs are presented in this appendix. A chart showing the Unified Soil Classification System is included at the end of this appendix.

All test pits were backfilled with the excavated soils, which were placed in 2- to 3-foot thick lifts and loosely compacted with the trackhoe bucket. Please note that if these test pits coincide with the future footing locations, the upper 4 feet of the backfill in the test pits should be removed and then backfilled with structural fill.

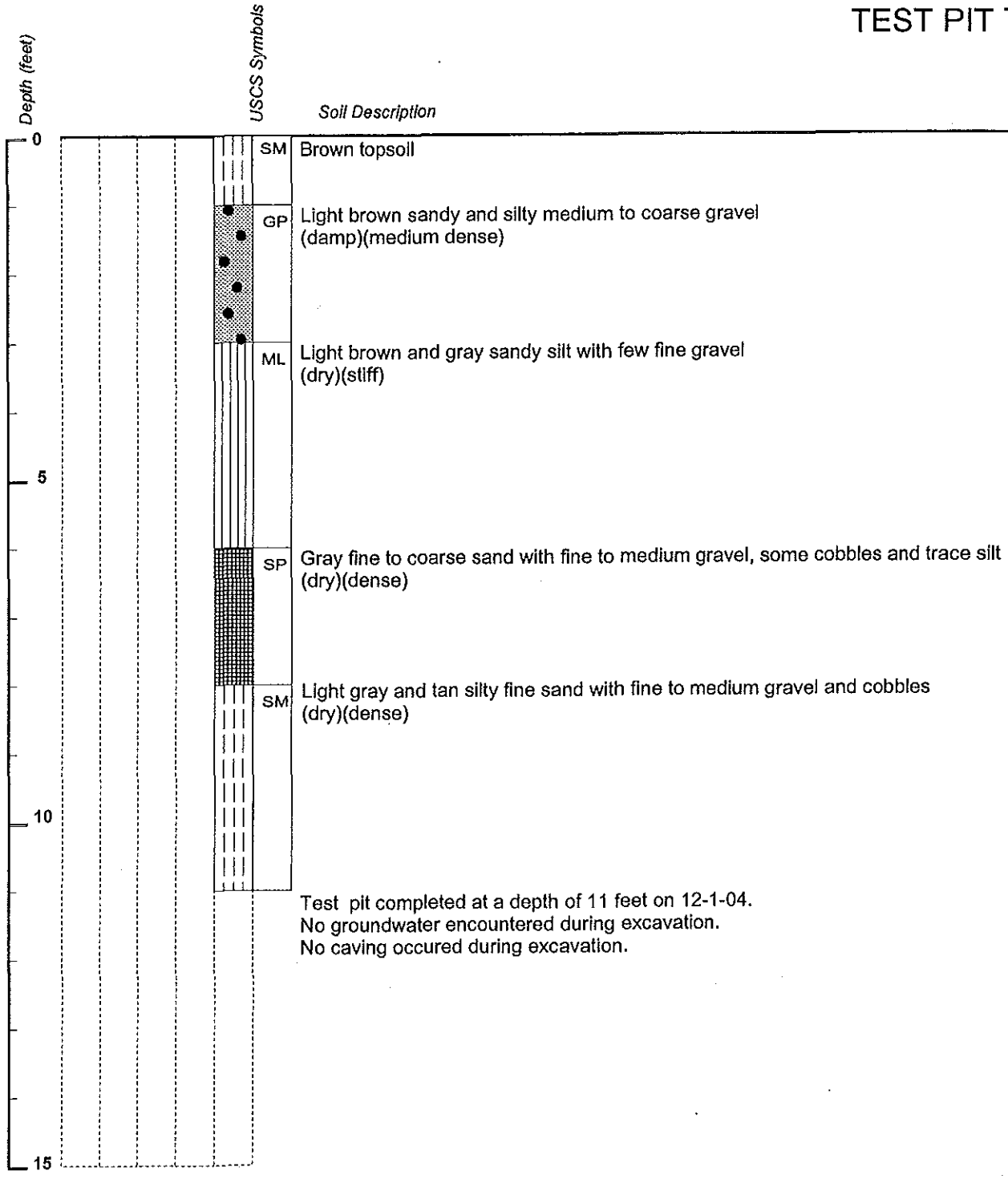
TEST PIT TP-1



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: December 1, 2004

Figure A-1

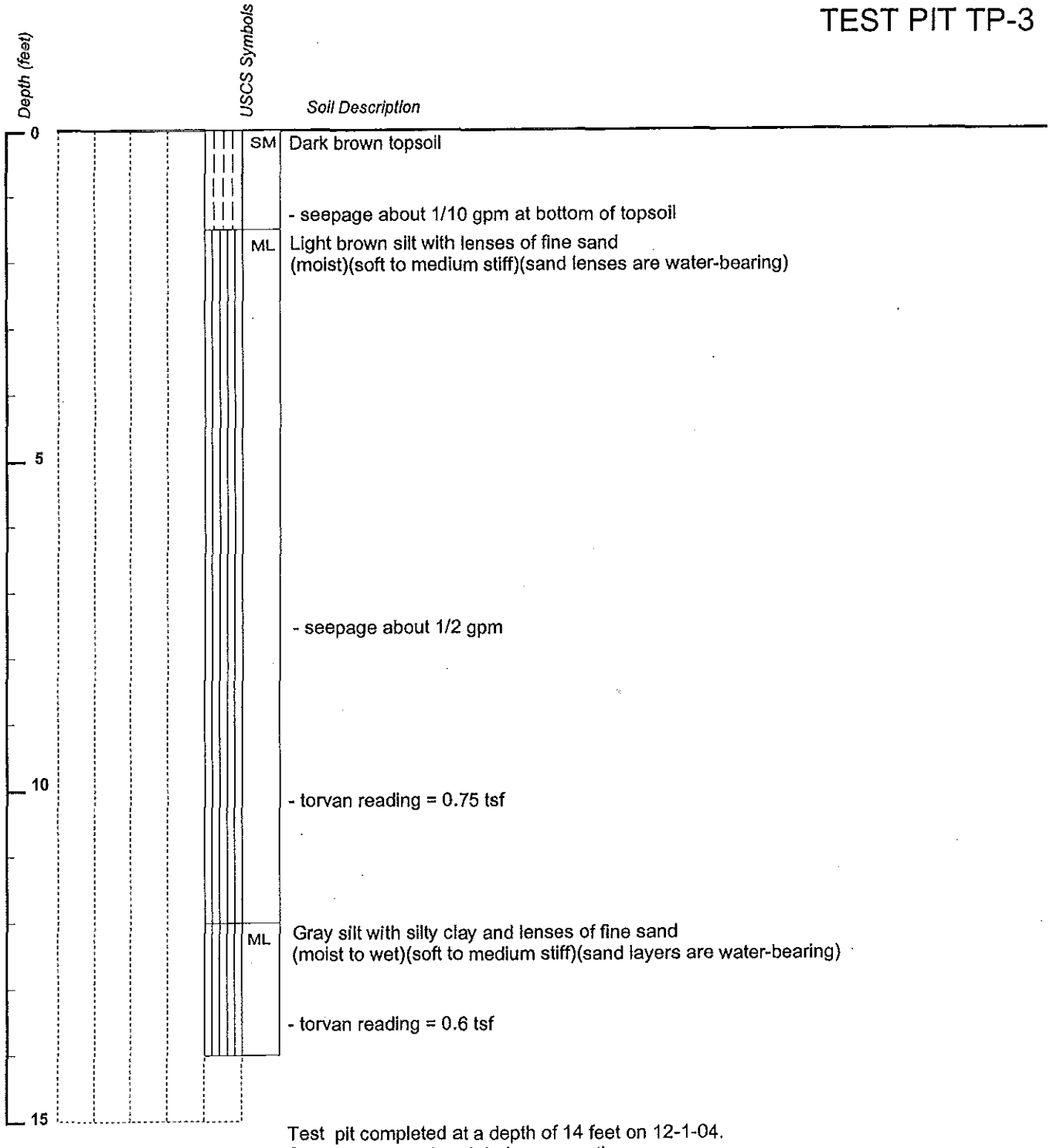
TEST PIT TP-2



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: December 1, 2004

Figure A-2

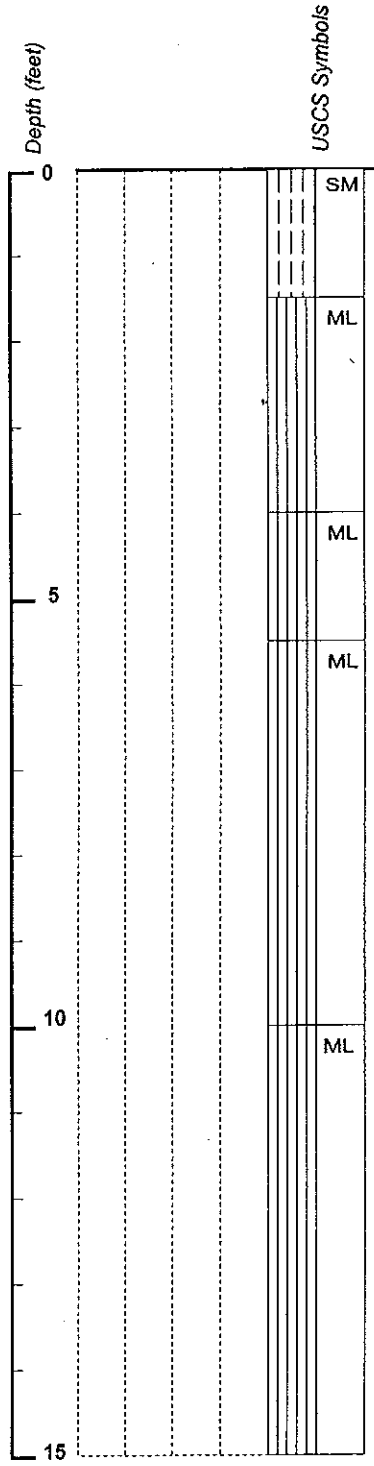
TEST PIT TP-3



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: December 1, 2004

Figure A-3

TEST PIT TP-4



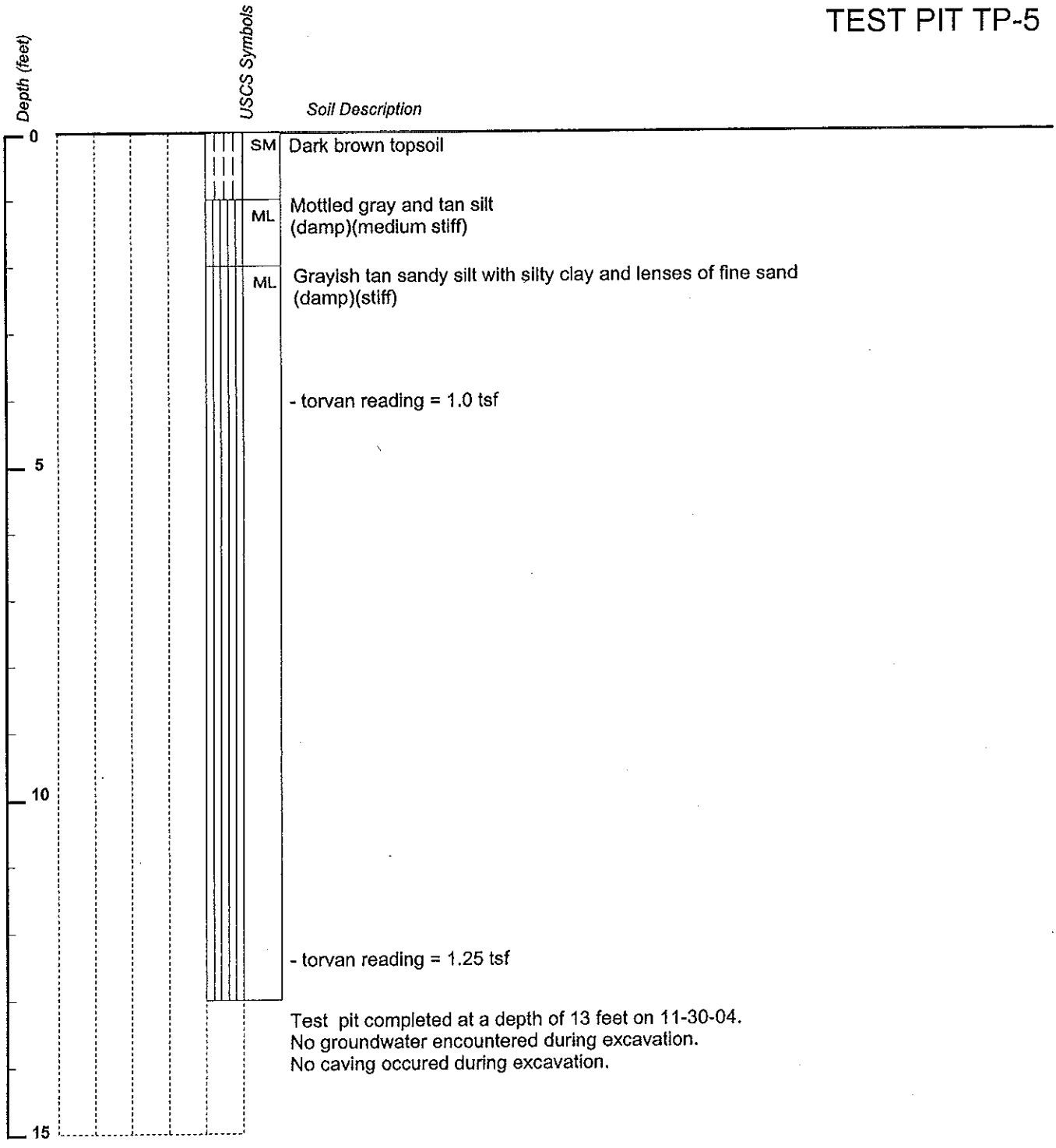
Soil Description	USCS Symbols
Dark brown topsoil	SM
Gray and brown mottled silt (damp)(stiff)	ML
Light brown gravely and sandy silt (moist to wet)(soft to medium stiff)	ML
- seepage about 1/2 gpm at 4 to 5 feet	
Yellowish tan sandy silt with layers of silty clay (moist)(stiff)	ML
Gray silt with lenses of fine sand (damp)(medium stiff to stiff)(sand lenses are water-bearing)	ML
- torvan reading = 1.0 tsf	

Test pit completed at a depth of 15 feet on 11-30-04.
Seepage encountered during excavation.
Some caving occured at 5 feet during excavation.

Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: November 30, 2004

Figure A-4

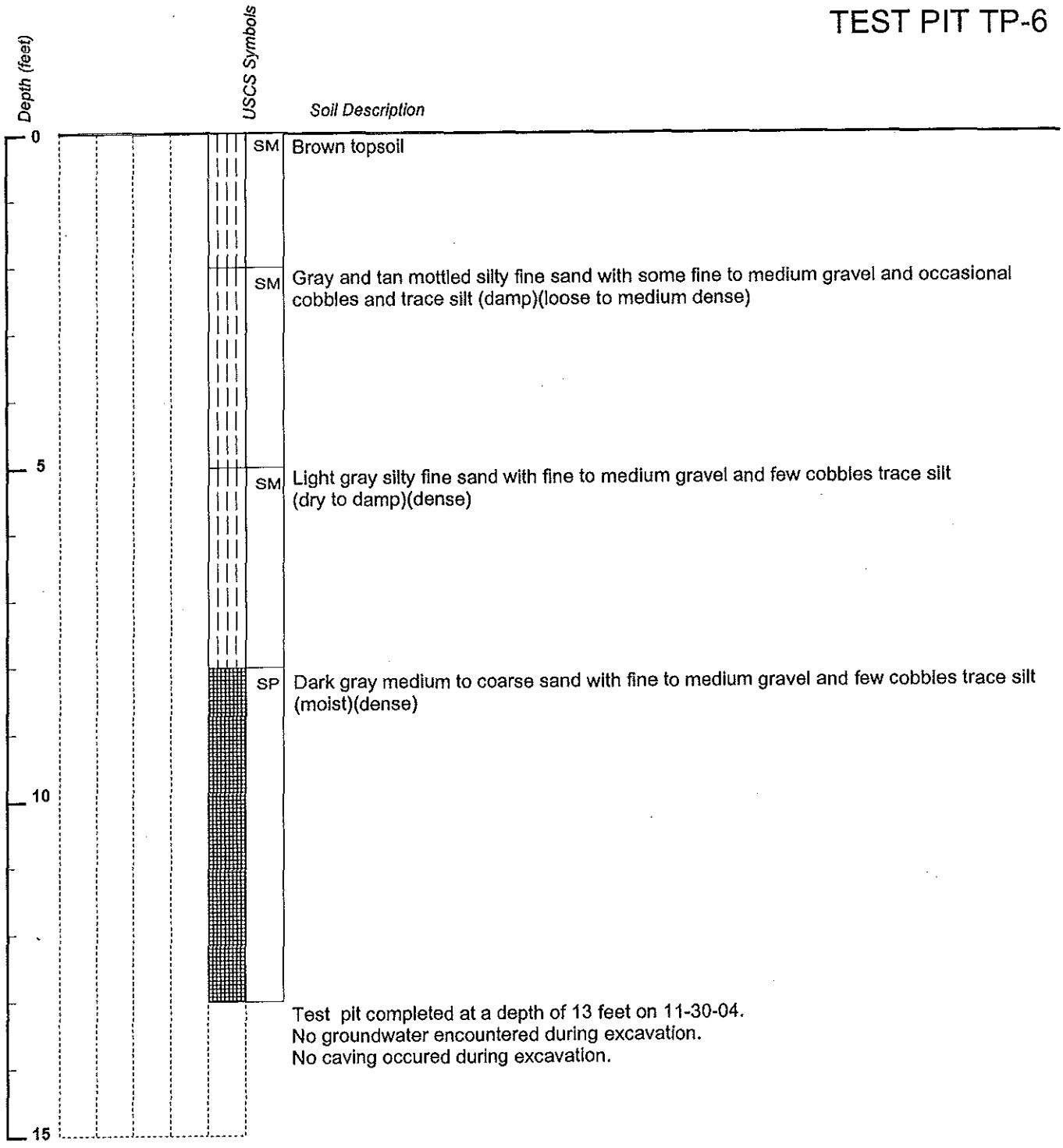
TEST PIT TP-5



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: November 30, 2004

Figure A-5

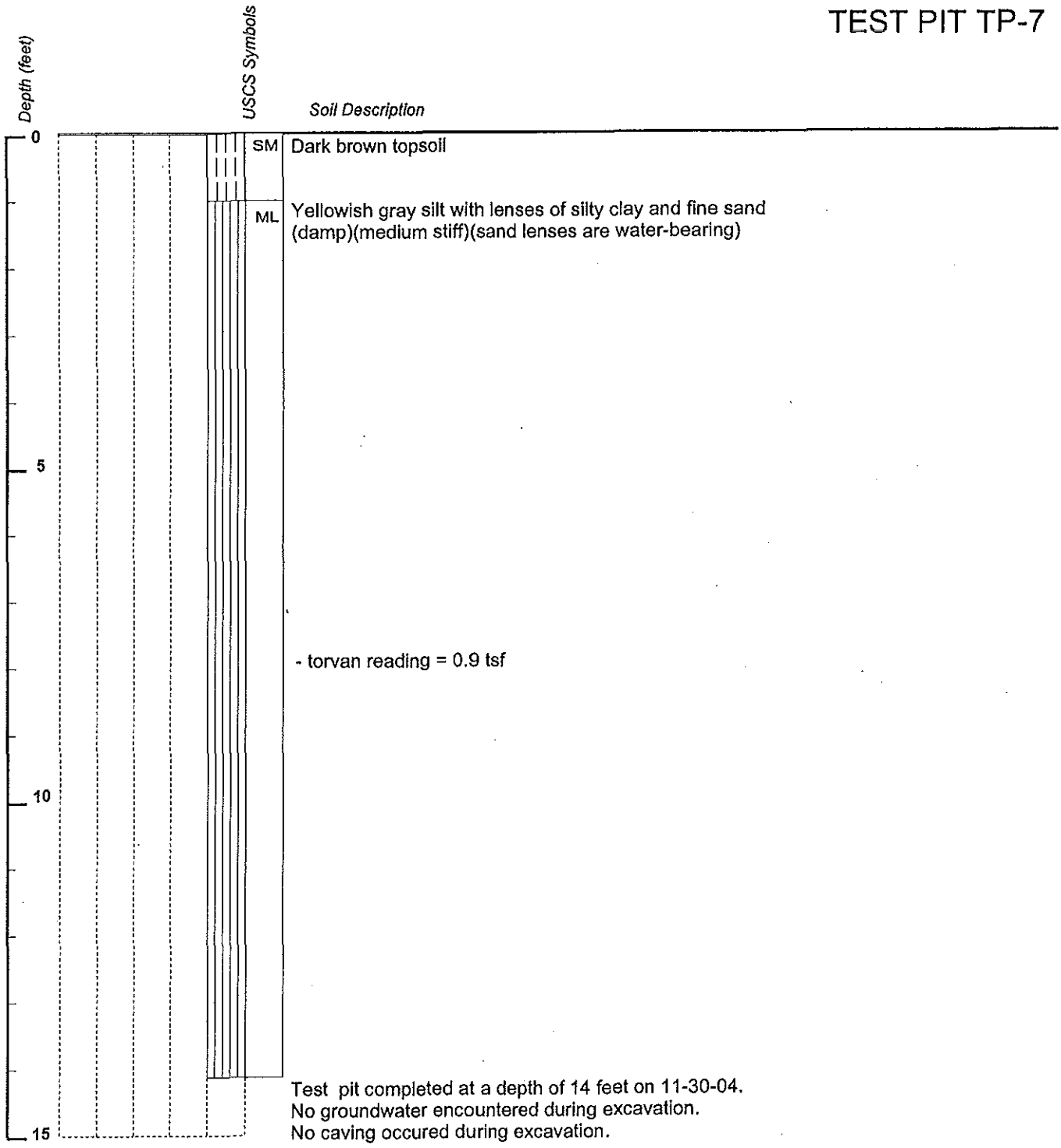
TEST PIT TP-6



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: November 30, 2004

Figure A-6

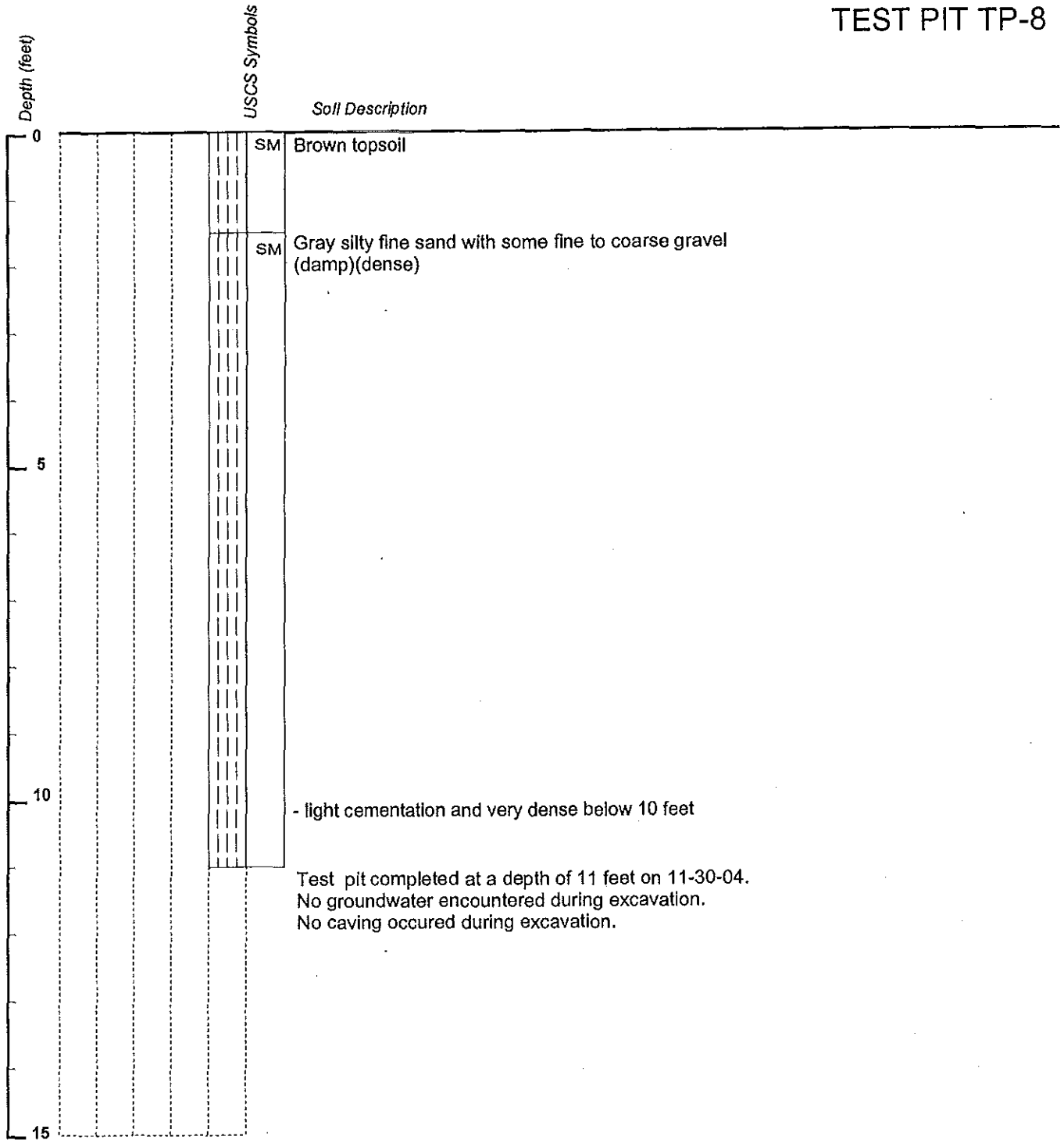
TEST PIT TP-7



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: November 30, 2004

Figure A-7

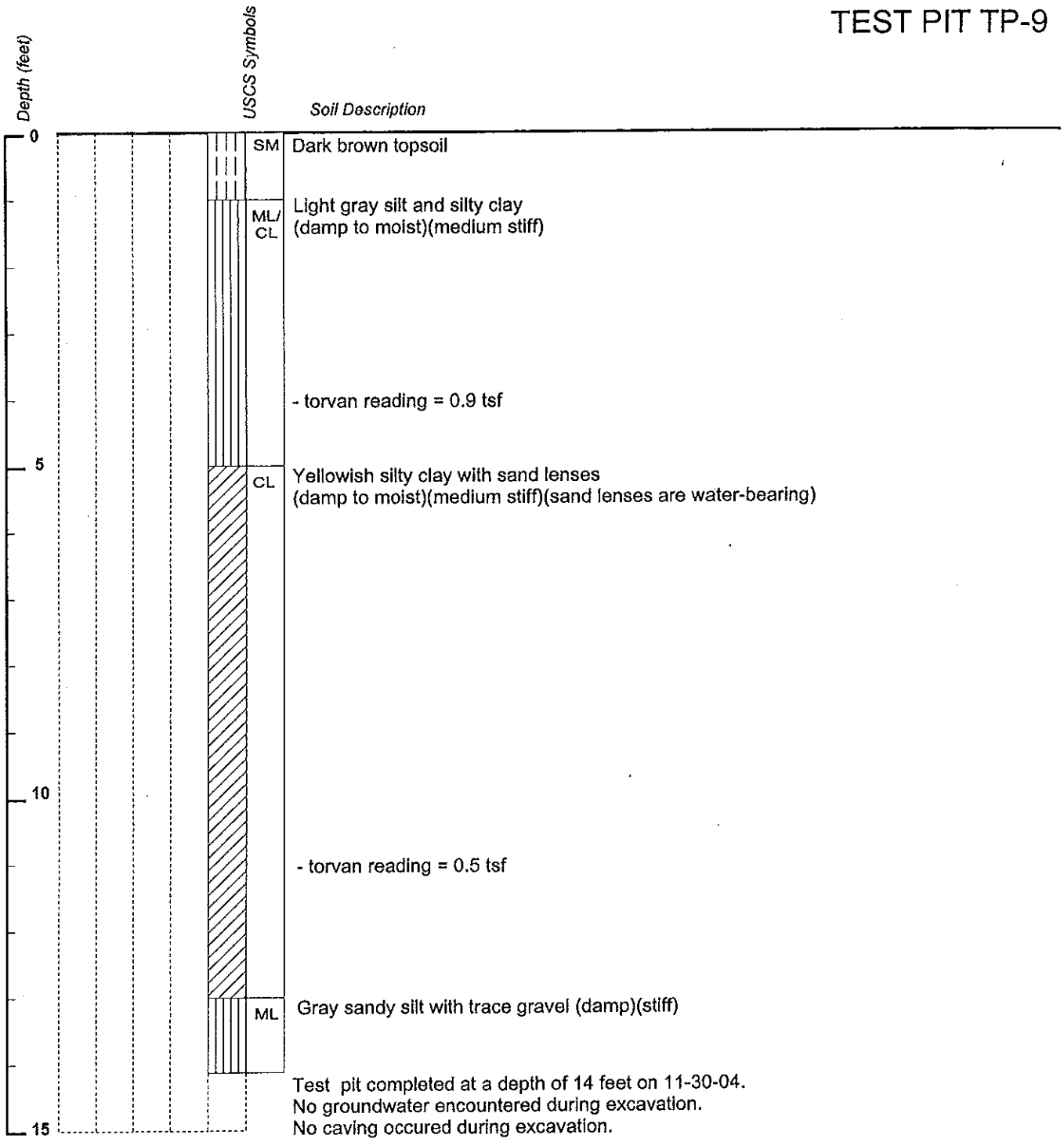
TEST PIT TP-8



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: November 30, 2004

Figure A-8

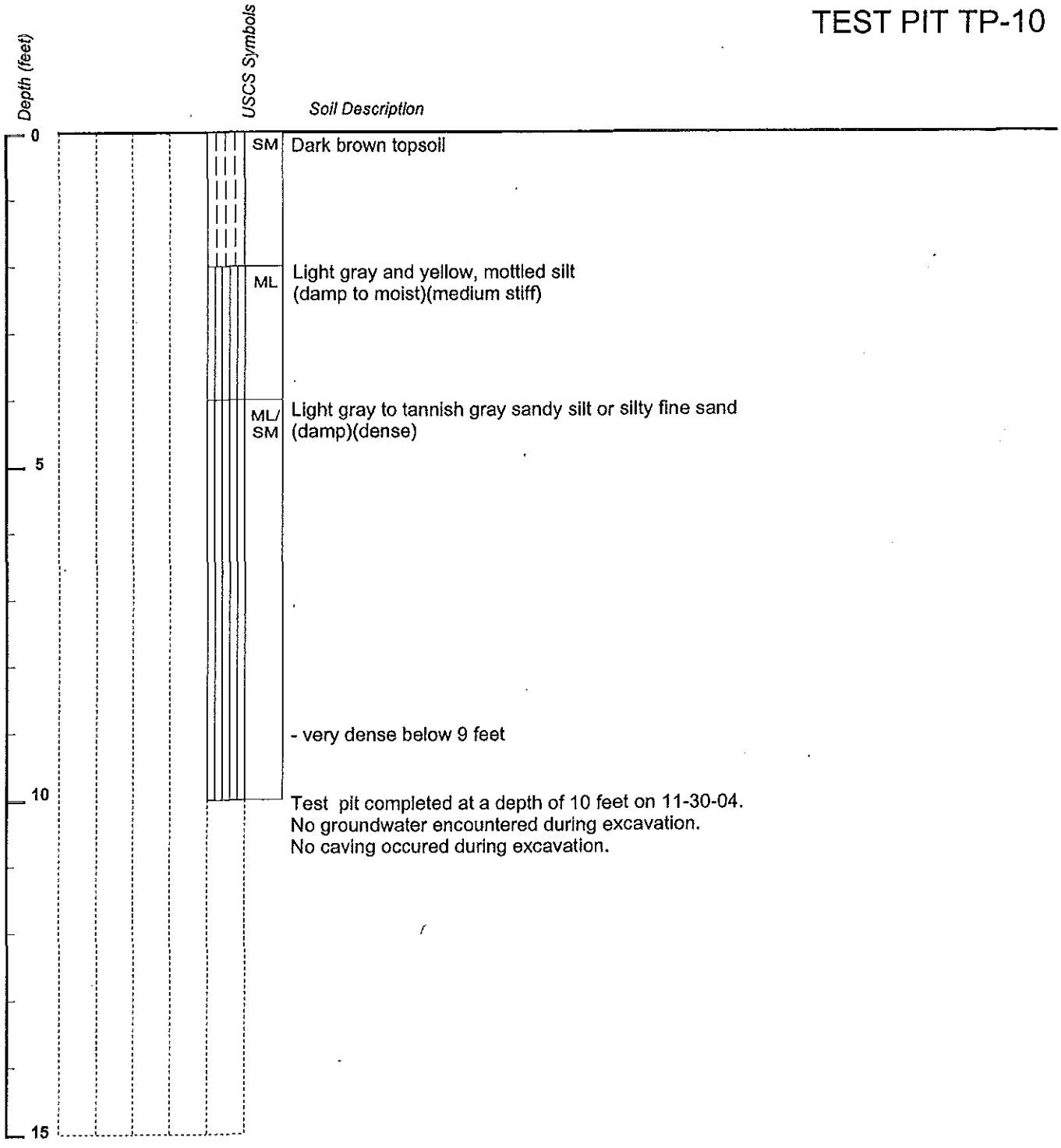
TEST PIT TP-9



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: November 30, 2004

Figure A-9

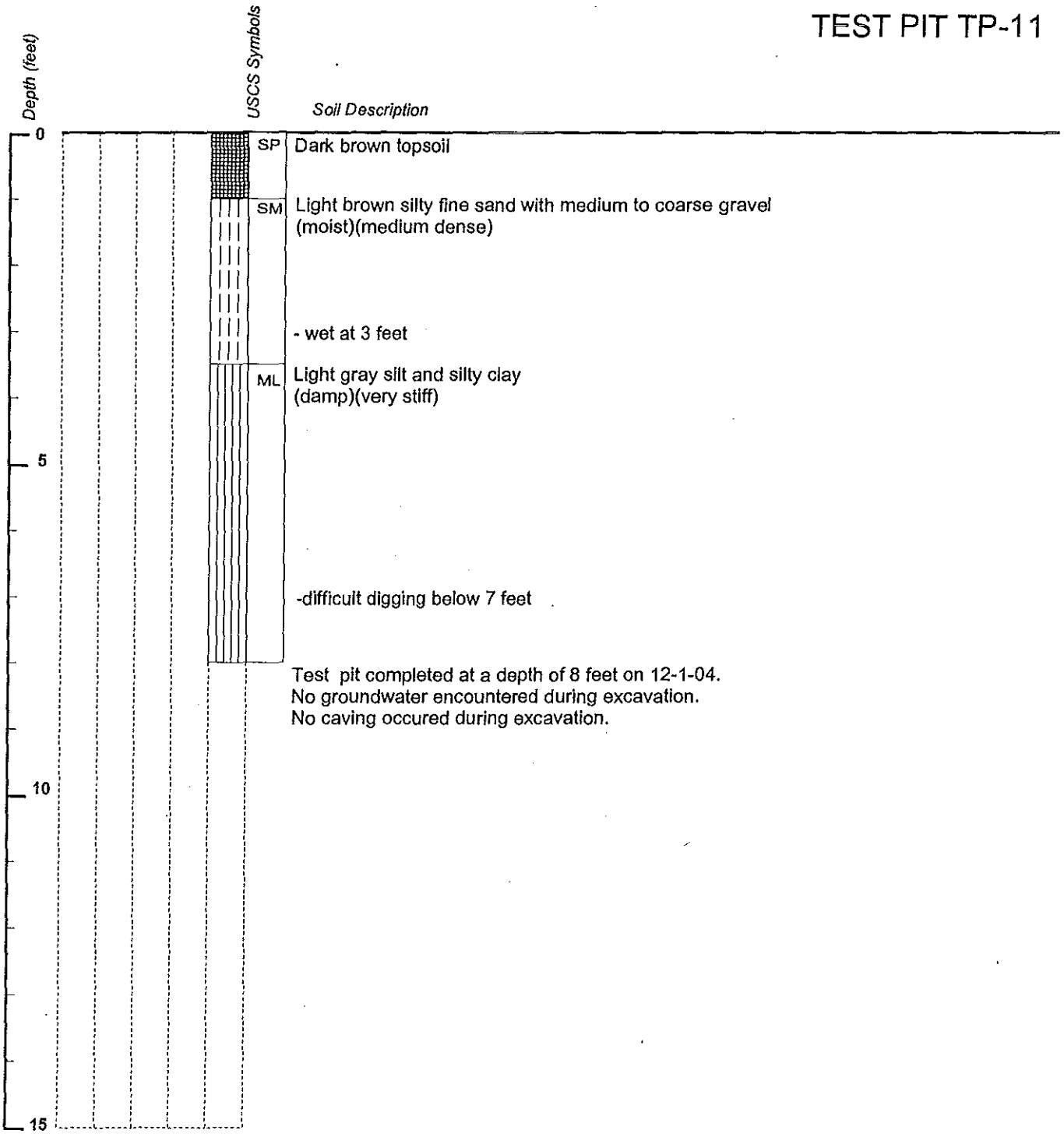
TEST PIT TP-10



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: November 30, 2004

Figure A-10

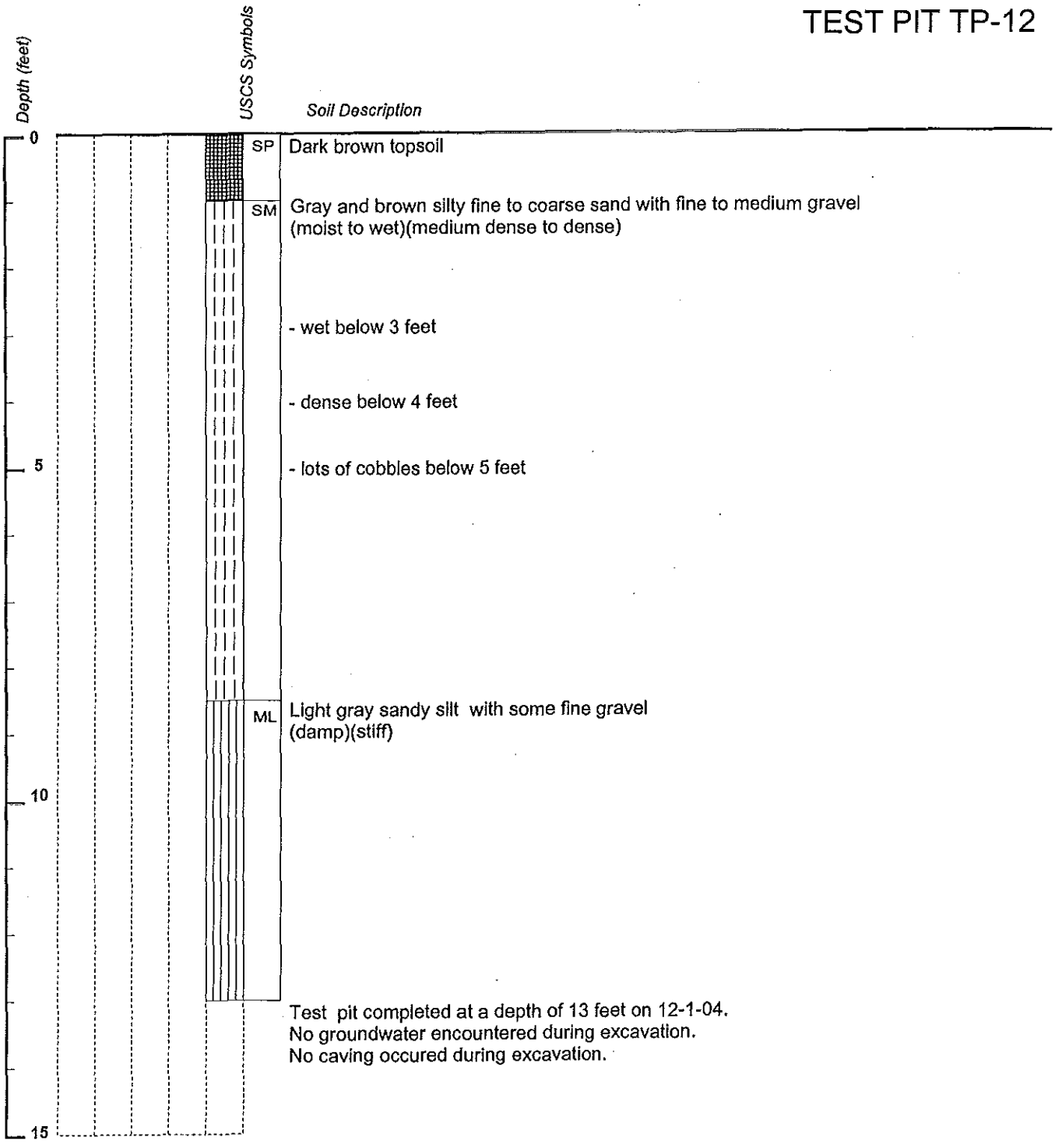
TEST PIT TP-11



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: December 1, 2004

Figure A-11

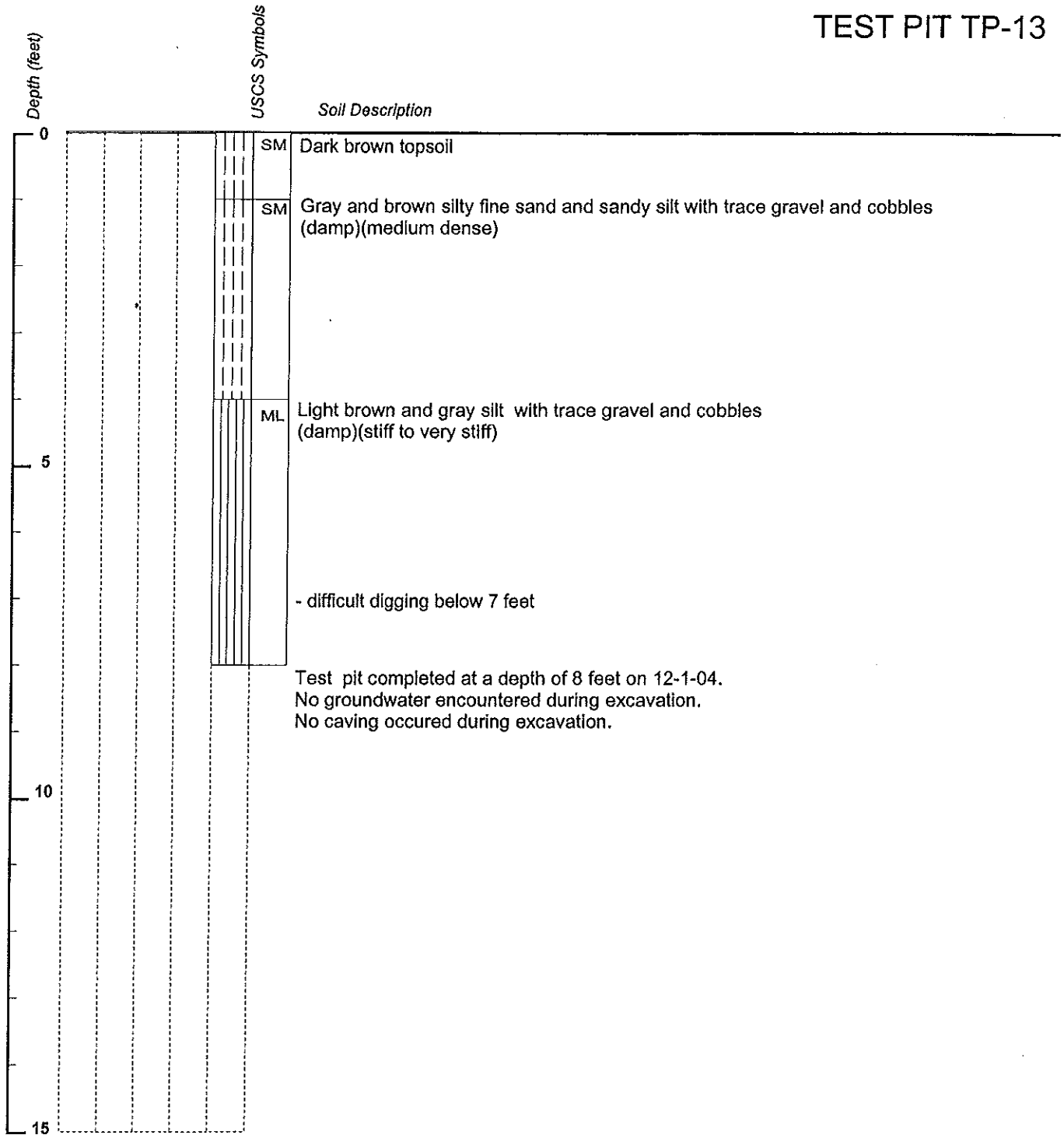
TEST PIT TP-12



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: December 1, 2004

Figure A-12

TEST PIT TP-13



Excavation Method: Hitachi EX120-5 Trackhoe
Excavation Date: December 1, 2004

Figure A-13

UNIFIED SOIL CLASSIFICATION SYSTEM

SYMBOL	LETTER	DESCRIPTION	MAJOR DIVISIONS		
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	CLEAN GRAVELS (LITTLE OR NO FINES)	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	COARSE-GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES			
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES			
	SW	WELL-GRADED SAND OR GRAVELLY SANDS, LITTLE OR NO FINES	CLEAN SANDS (LITTLE OR NO FINES)	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES			
	SM	SILTY SANDS, SAND-SILT MIXTURES	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES			
	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS & CLAYS LIQUID LIMIT LESS THAN 50		FINE-GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS			
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY			
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	SILTS & CLAYS LIQUID LIMIT GREATER THAN 50		
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS			
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS			
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS		

FOR VISUAL CLASSIFICATION, THE 1/4" SIZE MAY BE USED AS EQUIVALENT TO THE NO. 4 SIEVE SIZE

THE NO. 200 U.S. STANDARD SIEVE IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE

▽ DEPTH OF GROUNDWATER DURING EXCAVATION

SOIL CLASSIFICATION CHART AND KEY TO TEST PIT LOG

S&EE